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ABSTRACT

This curriculum guide is intended for use in teaching a unit on telecommunications to students with a basic understanding of computing. Introductory materials spell out the purpose of the unit--to provide an introduction to the sending and receiving of electronic information using a personal computer system and the telephone communications system--together with behavioral objectives and information on the timeline and the materials and equipment needed for the unit. Plans are then presented for four lessons, which require a minimum of seven 50-minute class periods: (1) Introduction to the Telecommunications Unit; (2) Data Transmission; (3) Electronic Bulletin Board System Procedures and Operations; and (4) Types of Networks. Each lesson includes a set of objectives for the lesson; a 10- to 15-item vocabulary list; an estimated time line; an overview of materials preparation; the content to be presented; a detailed description of classroom procedures; suggestions for additional classroom activities; and student worksheets. A glossary containing 59 key phrases is appended as well as a printout of messages produced by the public domain electronic bulletin board; lists of online networks (including connect and subscription costs) and communications software; masters for overhead transparencies designed for use in presenting the content of the lessons; and vocabulary word puzzles. (SD)

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A CURRICULUM MODEL FOR TEACHING TELECOMMUNICATIONS TO MIDDLE AND SECONDARY SCHOOL STUDENTS

Material Prepared by:

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May 1989

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TELECOMMUNICATIONS

TABLE OF CONTENTS

Page Number

Table of contents 2

Rationale. 3

Telecommunication Terminal Objectives 4

Overview 4

Telecommunication Lessons 6

Lesson One: Introduction to the telecommunications unit 6

Lesson Two: Data Transmission. 12

Lesson Three: Electronic Bulletin Board System Procedures and Operations. 19

Lesson Four: Types of Networks. 25

Appendix 1 - Glossary. 32

Appendix 2 - The listing of the public domain electronic bulletin board 39

Appendix 3 - Online networks 47

Appendix 4 - Communications software. 51

Appendix 5 - Overhead transparency masters 53

Appendix 6 - Vocabulary crossword puzzles . . . . .

RATIONALE:

Prerequisites - this is NOT a basic introduction to computers. This unit presupposes that the teachers and students understand the basics of computing, such as bits, bytes, RAM, ROM, disk drives, CPU, formatting data disks, loading, saving and printing information.

Today, far more importantly than the use of the computer as a computing device, is the use of the computer as an inexpensive communication device that is having a tremendous impact on society. Computers have made it possible for one person to communicate with another person anywhere in the world at any time. This capability allows users to access large volumes of information instantly in business and personal applications. It is now possible to access, from a home computer system, information contained in the world's greatest libraries.

Business relies on the telecommunications technology to transfer financial records and funds quickly, efficiently, and safely. Telecommunications is rapidly becoming commonplace in homes with computers. Up-to-date electronic encyclopedias are available for both home and school access using the telephone system. The old pen-pal concept is still alive and well, but it is now becoming an electronic activity where one's message is sent and received instantly.

Students today must be at least superficially aware of what telecommunications is, what it can do, how it is accomplished, and some of the equipment required. The use of modems in schools is on the increase, as noted in the annual QED surveys. The table below shows the increase in the number of schools purchasing and using modems.

Modems

List Description	1987	1988	% Increase
Elementary with Modems	2,330	2,858	23
Jr. High with Modems	1,036	1,247	20
Sr. High with Modems	1,905	2,237	17
Districts with Modems	1,468	1,676	14
Schools in Districts with Modems	23,127	26,048	13

Source: Educational Mailing Lists and Marketing Services, 1987 and 1988, QED, 1600 Broadway, 12th Floor, Denver, CO 80202-4912.

Therefore, the purpose of this telecommunications unit is to provide an introduction to the sending of and the receiving of electronic information using a personal computer system and the telephone communications system.

TELECOMMUNCIATION TERMINAL OBJECTIVES

At the end of this unit, students will be able to:

1. Define selected telecommunications terminology
2. Describe and illustrate telecommunications concepts
3. Discuss data communication modes using microcomputers and the telephone system
4. Describe and discuss the characteristics of different types of modems
5. Discuss the installation and configuration of various telecommunications equipment
6. Show typical telecommunication log-on procedures
7. Discuss and diagram selected types of networks

OVERVIEW

1. Timeline - This unit will require a **minimum** of seven 50 minute class periods.

2. Materials and equipment needed

   a. Materials

      1. To give students telecommunications experiences, and to assist in the presentation of the telecommunications concepts, **one** public domain program disk, **three** shareware program disks can be acquired, and **two** MECC data disks can be created. NONE of the disks are required to complete this unit of instruction on telecommunications. However, without at least the Electronic Bulletin Board and Electronic Mail program simulation disk, the students will not be able to fully experience and appreciate telecommunications. The **six** computer disks are:

Commercial Disk:	The Electronic Village or The Information Connection.
MECC data disks:	QUICK FLASH telecommunications data disk (1) STUDY GUIDE data disk (1)
Public domain disk:	Apple II Electronic Bulletin Board and Electronic Mail (1)
Shareware disks:	IBM Telecommunications Simulation (1) IBM PC Board (2 disks)

NOTE: the public domain telecommunications computer disk is *recommended* for this unit. Thirty (30) minutes is needed to customize the public domain Electronic Bulletin Board. It is written in Apple Basic. (Should the teacher not know elementary Basic programming, some programming assistance is necessary). Should Apple computers not be available in some schools, or if the disk itself is not available, **Appendix 2** contains the program (code) listing for typing the telecommunications program into MS DOS (IBM) or other PC's. There may be some slight differences between Apple Computer Company's Basic language and Microsoft Basic and other versions of the Basic language commands. Consult programming manuals for each to note any differences in the commands and make the necessary changes. Typing these instructions will take about **four hours of time**, if no mistakes are made.

2. Thermal or Plain Paper Copier transparency film. Allow one hour to produce the necessary overhead transparencies from the included transparency masters in **Appendix 5.**

3. Blank computer disks for making copies of the telecommunications program and for saving downloaded files.

4. SOICC (State Occupational Information Coordinating Committee) manual, telephone number, and password. See **Appendix 3,** Online Networks, for additional SOICC information and/or see the school guidance counselor.

5. Telecommunications software, either public domain (such as FREETERM) or commercial software such as SmartTerm or Mousetalk.

b. Equipment

1. At least one computer for the classroom with a large monitor attached. If the information is to be displayed in 80-characters per line, a panel projection device is **emphatically** recommended to clearly see the information being displayed.

2. A modem, asynchronous (serial) card and appropriate cables.

3. Access to a telephone line.

4. An overhead projector.

TELECOMMUNICATION LESSONS

Lesson One: Introduction to the telecommunications unit

Objectives: At the end of this session the student will be able to:

1. Correctly write the definition of telecommunications
2. Create a simple sketch or diagram of two computers communicating and correctly label the equipment necessary for this process to occur.
3. State the function(s) of the labeled communications equipment
4. Describe in their own words and in writing, the meaning for the following telecommunication terms:

Vocabulary:

Character	Bit	Data bit
Serial Communication	Modem	Channel transmission
Parallel Communication	Simplex mode	Half duplex (Local echo)
Full duplex (Host echo)	Analog	Digital
Link control	Modulate	Demodulate

Teacher Notes:

Time line:

This lesson should take approximately 50 minutes.

This first lesson is to introduce the students to telecommunications. This is a lecture/discussion session using overhead transparencies (and communication cards, if available). At the end of the lesson, the students will diagram a telecommunications setup between two PC's and label the various components necessary for computer to computer communications to occur. If time permits, the study sheet will be passed out in class and the students will complete this during class or take it home and complete it overnight. It should be collected the following day, graded, and returned as quickly as possible.

Remove the cover of the computer to show the students the slot where the communications card is inserted into the motherboard. If the serial connection is built-in, point out the location of the serial connection.

Materials preparation:

Overhead transparencies will need to be prepared ahead of time by either the thermal or the paper copier method. The transparencies are numbered with the lesson number first and the sequence number second, for example, 1-1, lesson one, transparency one.

A photocopy of the glossary may be made for each student by xeroxing the included glossary. Another solution is to use the **MECC flash card disk** that contains the glossary. The entire glossary or selected terms may be printed as needed.

A study sheet is included for student use.

Content:

Transparency 1-1 will be used to show the telecommunications setup between two PC's. The teacher will have to identify the various components of the setup along with a detailed explanation each component. A teacher study sheet is included for your convenience. You must explain that the information (originator) sent from one computer to another (receiver) is first converted from parallel to serial digital information, then MODULATED (changed) to be transported by telephone lines to the receiver, DEMODULATED (changed back) to digital information and finally converted from serial back to parallel digital information for computer processing. See **Transparency 1-2,** Digital Modulation, for the physical characteristics of binary, DIGITAL information converted to its ANALOG form by the modem. The purpose of the ASYNCHRONOUS or SERIAL cards is to convert the parallel digital information into serial digital information. (At this point, have the students come up to the computer in groups to see the communications card inside the computer). The purpose of the modem is to do the digital - analog - digital conversions. Computers internally process information in parallel, but must use a serial or asynchronous card for telecommunications.

Transparency 1-3 shows an example of the physical control of data transfer, both parallel and serial. This parallel data transfer occurs in the CPU and the serial data transfer occurs in the serial card. Two analogies which may be useful to conceptualize parallel and serial are 1) parallel; envision that you are on an overpass of an eight lane highway where there is a car in each lane, all traveling side by side at the same rate of speed. Analogy two uses an oscillating lawn water sprinkler where each hole on the arm is parallel to each to each other and the individual streams of water are parallel to each other. 2) serial; envision that you are standing beside a single lane road, where all the cars must travel in a straight line, one after the other. Analogy two uses a pulsating water sprinkler. The little metal flapper breaks up the stream of water into small bursts. Serial cards can either be add-ons, as in Apple IIe and GS computers and most desktop MS DOS PC's, and are purchased as a separate item. Some can be built-in, such as in laptop computers and the Apple IIc, GS and Mac serial ports. Connecting cables for each are different and are not interchangeable from the add-on serial cards to the built-in serial ports.

Transparencies 4, 5, and 6 show the three types of communication channel transmissions or link control.

1-4 shows the SIMPLEX channel which allows only one way communication, usually from a PC to a larger computer.

1-5 shows the HALF-DUPLEX (or LOCAL ECHO) channel that is similar to a CB radio type of transmission. One computer can send and the other can receive. Both computers cannot send and receive simultaneously. One computer must first relinquish the send function in order for the other computer to send information.

1-6 shows the FULL-DUPLEX (or HOST ECHO) channel that is similar to a telephone. Information from two PC's can be sent and received simultaneously. This is the more convenient form of telecommunications.

Materials and equipment:

One overhead projector

One thermal or paper copier

Transparency film and the telecommunications transparency originals

One Apple Super Serial card and/or one MS DOS asynchronous card and/or one

MS DOS synchronous card. (These cards are not required, but they will add a significant aspect of realism to the lesson)

A copy of the Student Study Sheet for each student

One computer

MECC Quick Flash program and data disk

Classroom Procedures:

After instruction and discussion, direct the students to take a piece of blank paper and create a telecommunications system between two PC's. Tell them to label and state the function of the parts. Turn this in before the class period ends. See the **Teacher Study Sheet TS 1-1** for an example of what the final diagram should represent.

Distribute the **Student Study Sheet** and have them begin working on it in class or take it home to complete and return the next day.

Additional Activities:

Students can have an "online" telecommunications experience by calling a business (such as credit unions) or a family that has a telephone answering machine. Ask the class to see who has not had such an experience. If they have not, set up such an experience for them.

Handouts and Transparency Masters:

See the following attached materials and Appendix

STUDENT STUDY SHEET

Explain in detail and in your own words, the meaning of each of the following terms from Lesson One.

Character

Serial Communication

Data Bit

Bit

Parallel Communication

Modem

Channel Transmission/Link Control

Simplex Mode

Digital

Half Duplex (Local Echo)

Analog

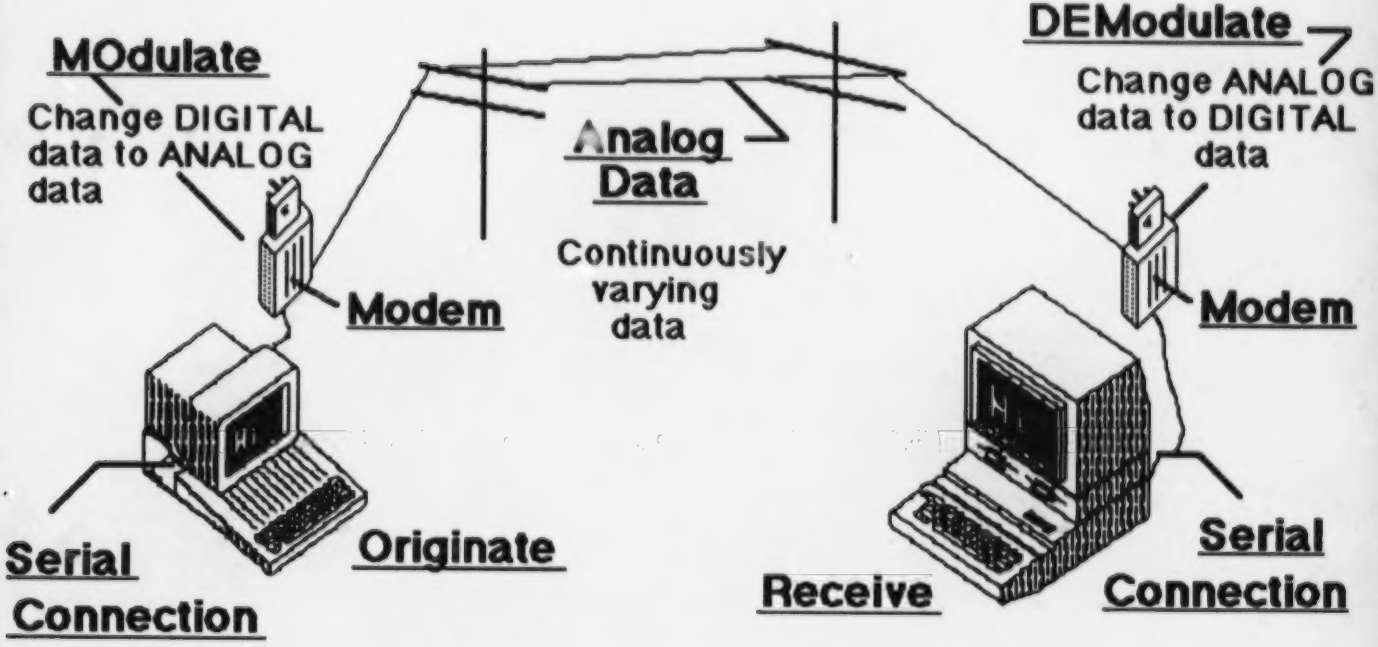
Full Duplex (Host Echo)

Modulate

Demodulate

TELECOMMUNICATING

(Teacher Study Sheet)



TS 1-1

Lesson Two: Data transmission

Objectives: At the end of this session the student will be able to:

1. Draw a diagram to show the difference between synchronous and asynchronous information; also, describe in writing these differences
2. Identify and explain the parts of a data byte
3. When shown two communication cards, correctly identify which one is an asynchronous communication card and which is a synchronous communication card
4. Determine the correct terminal setting for an Apple Super Serial card in both MODEM and TERMINAL modes
5. State the reason for using a PARITY bit
6. List the three types of PARITY and describe each of these types in writing
7. Describe in writing the difference between 300 bps and 1200 bps data speed
8. List in writing three reasons for using START and STOP bits
9. List in writing six asynchronous card functions
10. Define in writing the communication terms listed below:

Vocabulary:

Asynchronous	Synchronous	Baud
Dip Switch	Framing Bits	Stop Bit
Start Bit	Parity Bit	Inactive Time
Terminal Block	Super Serial Card	

Teacher Notes:

Timeline:

This lesson will take approximately 100 minutes or two 50 minute class periods.

Spend about 5 minutes reviewing lesson one and collecting the students' homework.

Materials preparation:

Overhead transparencies will need to be prepared. As in Lesson One, the transparencies will be numbered with the lesson number first and the sequence number second, for example, 2-1, lesson two, transparency one. The teacher may make copies of the transparency masters for the students, if this will facilitate less note-taking in class.

Have the terms written on the chalkboard or on an overhead transparency. Define the terms and then go into the lesson content.

Acquire an Apple Super Serial card and IBM asynchronous and synchronous communication cards. (These can be borrowed from your dealership or another computer dealership. Ask if they can donate non-operative communication cards to you for educational purposes or for use on a loaner basis.)

The teacher may use the **MECC flash card disk** created earlier to print out the communication terms covered in this lesson.

A student study sheet on terminology is included for student use.

A student handout sheet called **Dip Switch Settings** may be duplicated for each student and used with the Apple Super Serial card topic. The student will set switches on paper that correspond to actual Super Serial card switches by marking the appropriate area on the handout sheet.

Make a second copy of the dip switch settings student study sheet to test the students on specific switch settings of the Apple Super Serial card. This test sheet can be administered at the end of this lesson or at the end of the next lesson, or as part of a unit test.

Content:

This second lesson covers data transmission. Again, this is mainly a lecture/discussion session using overhead transparencies and communication cards. At the end of the lesson the student will diagram synchronous and asynchronous information and explain the difference noted. The students will have to identify the differences between synchronous and asynchronous communication cards. At the end of the second day, if time permits, pass out a study sheet in class and have the students complete this during class or take it home and complete it overnight. It should be collected the following day, graded, and returned as quickly as possible.

Show the students the difference in data speed between 300 bps and 1,200 bps. Most modems are capable of these data speeds. Check the manual for your modem's capabilities. Also check the communications program manual for any software settings that may need to be changed. Log on to a local bulletin board in your area or use the tutorial/demonstration program in the commercial package "The Electronic Village".

Review lesson one. Allow five to 5 minutes to clear up misconceptions and answer questions. Collect lesson one study sheets at this time.

Pronounce and **define** the vocabulary words for this lesson. Pass out any glossary sheets if so desired.

The *first* concept is asynchronous versus synchronous data transmission. **Transparency 2-1** illustrates the concept of **asynchronous data transmission.** This transmission uses **start, stop** and **parity** bits. Start, stop, and parity bits are important because they separate each **byte** of information

being exchanged. There is a very brief time delay between the STOP bit of one data byte and the START bit of the next data byte. This is referred to as **inactive time. Parity bits** are used for error checking. This is to guarantee that the data bytes sent are received correctly. Various parity checking systems have been developed, such as **EVEN** (total number of 1's is even), **ODD** (total number of 1's is odd), and lastly, **NONE** (no bits are added). In asynchronous data transmission, data bytes are transmitted at *irregular* times.

Transparency 2-2 illustrates the concept of **synchronous data transmission.** Data is sent and received in a continuous stream of bits with no inactive time between each data byte. Businesses uses this type of data transmission to sent huge files from one location to another, and one country to another.

Transparency 2-3 presents further detailed information about **Parity bits** and **Start** and **Stop bits.**

The *second* concept is data transmission speed. This refers to the number of bits sent across the telephone lines per second. This is erroneously referred to as **baud.** Baud is actually the number of *bytes per second* and not bits per second. However, baud has come to be know as the "bits per second" rate, but in reality it is not.

Transparency 2-4 shows a **baud rate table.** Discuss the various baud rates and show how these rates are determined. Emphasize that the higher the baud rate, the greater the amount of information that can be exchanged in the same amount of time. 300 bps and 1200 bps are the most common for home and school use where 2400 bps is beginning to become more evident. Information services such as Compuserve and The Source are beginning to provide 2400 bps service. 9600 is strictly for business use. At this point, if a modem is available, demonstrate the difference in speed between 300 and 1200 bps. (If a modem is not available, a superb substitute is the shareware Telecommunication Simulation by Dan Davidson, IBM format)

Computer manufacturers have evolved 2 means of serial communications capability for their computers. One uses a card plugged into an expansion slot on the motherboard, and the other incorporates the serial capability into the motherboard.

The *first* means, the asynchronous communication card, needs to be addressed. **Transparency 2-5** gives a summary listing of the functions of this card. There are two asynchronous cards, one for the Apple computer called the Super Serial card, and the other for MS DOS PC's, called the Asynchronous Communications Adapter.

Transparency 2-6 shows an Apple Super Serial card and its DIP switches. This card is used for serial transmission to either a modem or a printer. Two of these Super Serial cards can be used simultaneously for both telecommunications and printing. It must be configured (set up) for use with either the modem or the printer. The configuration components are the **DIP**

switches, jumper block, ROM chips and an **edge connector** that can be inserted in expansion slots 1 and 2. This enables combinations of printers and modems to be attached to the Apple II, II+,IIe, and IIGS computers. **BE SURE TO POINT OUT** that the triangle-shaped symbol on the terminal block must point to MODEM for use with telecommunication activities. For use with the PRINTER, the triangle must point to TERMINAL. The two banks of DIP switches are manually set to configure the card for printer or telecommunications activities.

At this time pass out a copy of the Dip switch settings handout. Show **Transparency 2-7**, the Apple Super Serial card modem switch settings. The **darkened** area is a switch in either the **UP** or **DOWN** position. Down is OPEN (OFF) and UP is CLOSED (ON). Have the students darken in areas on their handout sheet to reflect the modem settings. **Transparency 2-8** shows the Apple Super Serial card printer settings. Ask the students to point out the differences between the modem and printer settings. Have the students darken in the printer settings on their handout. Discuss the settings and have the students define baud, stop and start bits and parity.

Transparency 2-9 shows the asynchronous communication adapter for the MS DOS PC's. Point out the **lack** of configuration switches. The **primary** difference between the Apple Super Serial card and the MS DOS card is that **ALL configuration** changes are accomplished by communications software as opposed to manual switch settings.

The *second* means of serial data transmission is the built-in serial capability into the design of the motherboard. **Transparency 2-10** shows this built-in capability in the Apple IIc computer. Point out the two built-in **serial ports** - #1 is for a printer and #2 is for a modem, hence the telephone "icon" or symbol. However, a printer can be connected to the modem connection, and/or a modem can be connected to the printer connection. This is **NOT** the same as a built-in modem; this is only a built-in modem **connection.** DO NOT CONFUSE THE TWO! (The Tandy 200 has a built-in modem.)

Transparency 2-11 shows an MS DOS synchronous data link adapter. this type of communications card is used for rapid data exchange at very high rates **above** 9600 bps.

Materials and Equipment:

One overhead projector

One thermal or paper copier (if transparencies have not been prepared previous to this time)

Transparency film and the telecommunications transparency originals

One Apple Super Serial card and/or MS DOS asynchronous card and/or one MS DOS synchronous card to pass around to students

A copy of the Student Study Sheet for each student

A copy of the DIP Switch Settings Student Handout

A copy of the glossary or a listing of the communications terms to be learned for this lesson

For enrichment:

A modem for demonstration of the differing baud rates

A copy or multiple copies of any public domain, shareware, or a commercial program that shows differing baud rates, such as the IBM format program

Telecommunication Simulation

Classroom Procedures:

During discussion of the Apple Super Serial card pass out the DIP switch student handout. Have the students emulate setting switches by darkening in the appropriate switch boxes on the handout.

IF there is a modem available or IF the IBM format shareware program **Telecommunication Simulation** is available, demonstrate the differing rates of transmission speed to the students. Have this setup and ready to demonstrate before class begins.

CAUTION: for the modem demonstration, a panel projector is necessary for the entire class to see the information legibly on the screen . The tutorial program in "The Online Connection" is of sufficient size for the class to comfortably view the information being displayed on a large classroom monitor.

Distribute a copy of the Student Study Sheet to each student. Have them complete the work in class if time permits, or have them complete the work at home and return the study sheet at the beginning of the next class session. Collect the study sheet immediately before beginning lesson three. Grade and return the study sheets to the students the following class session.

Handouts and Transparency Masters:

See the following attached materials and Appendix

STUDENT STUDY SHEET

Explain in detail and in your own words, the meaning of each of the following terms from Lesson Two.

Asynchronous

Dip Switch

Start Bit

Terminal Block

Synchronous

Framing Bits

Parity Bit

Super Serial Card

Baud

Stop Bit

Inactive Mode

Lesson Three: Electronic bulletin board system procedures and operations

Objectives: At the end of this lesson the student will be able to :

1. Identify the 5 main activities conducted on a bulletin board system and describe in writing the process to accomplish each activity.
2. Logon a remote bulletin board service.
3. Post a message to a remote bulletin board service.
4. Access and read messages previously posted on a remote bulletin board service.
5. Upload a disk file to a remote bulletin board service.
6. Download a disk file from a remote bulletin board service.
7. Define in writing the communications terms listed below.

Vocabulary:

Logon	Logoff	Upload
Download	Terminal Program	Terminal
Bulletin Board System	Protocol	Autodial

Teacher Notes:

Timeline:

This lesson will vary according to the resources available in the local school but a minimum of 150 minutes or three 50 minute class periods for demonstration is recommended.

Material preparation:

Have the terms written on the chalk board or on an overhead transparency. Define the terms and then start the lesson content.

Acquire a telecommunications software program for the type of computer system available in your school setting. (These are available through commercial dealers or through public domain and shareware sources.) This software will allow you to use your computer equipped with a modem and phone line to gain access to a remote bulletin board service in your local. In the event that your school doesn't have a modem or phone connection available, use the bulletin board simulation public domain software available in Apple II diskette format, or in copy the program code form located in **Appendix 2.**

Call a local computer club for a listing of free bulletin board services in your area.

The teacher may use the **MECC flash card disk** to print out the communication terms covered in this lesson.

Classroom Procedures:

Review Tesson Two. Allow 5 to 10 minutes to clear up misconceptions and answer questions. Collect Lesson Two study sheets (if assigned as homework.)

Pronounce and define the vocabulary words for this lesson. Distribute any glossary sheets if so desired.

Content:

The *first* concept for this lesson is the correct configuring of the terminal program software to be used for accessing a remote bulletin board. To successfully link up with a remote BBS the terminal program you are using must have the same **protocol** settings as the BBS does. This requires setting the baud rate, stop and start bits, and the parity bits properly. The normal setting for most remote bulletin board systems is 8 data bits, 1 stop bit, and no parity. In the event that you attempt to link up to a bulletin board service and you cannot read the characters displayed on your screen by the remote system, you will need to adjust you protocol settings to another configuration (most likely, 7 data bits, 2 stop bits, and even parity.)

The *second* concept is to utilize the **autodial** function of your terminal program to enter the phone number of the remote bulletin board located in your area and establish a link with the BBS.

The *third* concept is to demonstrate the **logon** procedures for the remote bulletin board system in your area. These procedures may vary from BBS to BBS, but generally involve the entering of the users name, address, and pass word. After this initial logon the BBS may require you to register as a valid user of the system. This procedure may require that the user identify her/himself in more detail by giving additional address information. This information may be checked by the bulletin board **SYSOP** (system operator) to determine if you qualify for access to all of the available bulletin board functions. Upon completion of the logon procedures, the bulletin board systems will usually display any special announcements to its users and proceed to the main bulletin board menu.

Upon arrival at the main menu, the user can chose from the available system functions. These usually include the reading of posted messages, the entering of messages for others to read, and the **uploading** (sending to) and the **downloading** (receiving from) of disk files. The Apple public domain Electronic Bulletin Board simulation will give the students a real, hands-on experience with telecommunications. Time may be allocated for this activity at this point.

The *fourth* concept is to demonstrate the proper procedures for entering and reading messages on a bulletin board service. This technique may vary from one bulletin board to another, but basically involves the selecting of a menu item to enter messages from the main menu, defining who the message is sent to (for an individual user or for all users to read), entering the text of the message, and

saving it to the disk of the host computer. Reading posted messages involves selecting the read message menu option from the main menu and selecting each message that is posted to be read.

The *fifth* concept is to demonstrate the correct procedures to upload a disk file from your computer system to the remote bulletin board system and to download a disk file from the BBS to your computer. Menu selections for these activities are provided on the main menu of bulletin boards. Uploading a file requires that the user identify the name of the file on his computer that is to be uploaded. The BBS will prompt the user when to begin transmitting the file and the user instructs the terminal software that is in use when to begin the upload. When the upload is complete the BBS notifies the user that the transfer has been completed. Downloading a disk file from a BBS is essentially the same process in reverse. The user identifies the file from a listing of files available on the BBS, the BBS instructs the user when to begin receiving the file, the user instructs the terminal software that the download is beginning, and the file is saved to the user's disk automatically.

The autodial, logon, message reading and posting, uploading and downloading procedures can be demonstrated repeatedly for all the bulletin board systems in your area. Students can demonstrate their mastery of these concepts by actually performing each activity with one or more bulletin board systems.

Upon completion of the above listed activities the BBS software will allow the user to return to the main menu of the program. If the lesson is to conclude at this point, the logoff procedures for the BBS should be demonstrated. This usually involves selecting a menu item to disconnect from the BBS and in many systems allows the user to leave a message directly to the SYSOP. It is recommended that the instructor leave a message to the sysop indicating that he or she is using the bulletin board for instructional purposes. Upon completion of the message entry the BBS will disconnect from the phone system and the terminal software on your computer system will notify you of the disconnect. The user may then select the autodial function again, or exit the terminal program.

An excellent telecommunications experience for the students would be to have an electronic bulletin board system set up in the classroom using the **Apple** format **Electronic Bulletin Board Simulation,** or a dial-up service for students sponsored by the school, and maintained by the computer person and a computer user's club. This can be accomplished with the copyable, shareware **PC BOARD** software program. This is listed in Appendix 4. The equipment needed is a dedicated computer system with a harddrive, modem, and a telephone line.

Materials and Equipment:

Terminal software

Microcomputer system equipped with a modem (Recommended: large screen monitor if text in 40 characters; panel projector if text is in 80 characters)

Access to a telephone line

The telephone number of a BBS in your area

A copy of the student study sheet

A copy of the glossary or a listing of the communications terms to be learned in this lesson

Overhead projector

OPTIONAL:

Apple format Electronic Bulletin Board public domain program

A dedicated computer system for a bulletin board and the PC BOARD IBM format shareware bulletin board program or a suitable Apple version.

Student Study Sheet

Explain in detail and in your own words, the meaning of each of the following terms from Lesson Three.

LOGON:

LOGOFF:

UPLOAD:

DOWNLOAD:

TERMINAL PROGRAM:

TERMINAL:

BULLETIN BOARD SYSTEM:

PROTOCOL:

AUTODIAL:

Lesson Four: Types of Networks

Objectives: At the end of this session the students will be able to:

1. Verbally describe, in their own words, the difference between a LAN and a WAN
2. Describe the LAN networking process. List the components of such a process and state the function of each component
3. State the role of the server in the network
4. Diagram each of the three topologies
5. List and describe, in their own words, the advantages and disadvantages of the three topologies

Vocabulary:

Bus topology	LAN	Network topology
Ring topology	WAN	Coaxial cable
Ring network	Star topology	Server
Star network	Twisted pair	Smart modem
Dumb modem	Optical fiber	

Teacher Notes:

Timeline:

This lesson should take approximately 60 minutes.

Materials preparation:

Overhead transparencies will need to be prepared ahead of time by either the thermal or the paper copies method. The transparencies are numbered with the lesson number first and the sequence number second, for example, 4-1, lesson four, transparency one.

A study sheet is included for student use.

This fourth lesson is to introduce the students to the common types of networks used during telecommunications. This again is a lecture/discussion session using overhead transparencies and small pieces of **coaxial cable** and **optical fiber** to pass around to the students during the discussion of this topic. Acquire short (6 inch) lengths of **coaxial cable** by asking for samples from a local cable TV company, or purchase a 25 foot roll at an electronics store. Also acquire a few samples of **optical fiber** to compare with the coaxial cable. Both are used for data transmissions. If possible, acquire an example of a laptop computer with a built-in modem, an internal modem and an external modem. It will take some time to acquire the above equipment and materials, but it will be worth it.

Have the terms written on the chalkboard or on and overhead transparency. The teacher may use the **MECC flash card disk** to print out the communication terms covered in this lesson.

A study sheet on terminology is included for student use.

Two crossword puzzles (and the answers) are included for review and study of the telecommunications terms for the entire unit. These may be assigned at any time during or after this lesson.

Review lesson three. Allow five to ten minutes to clear up misconceptions and answer questions. Collect lesson study sheets.

Pronounce and **define** the vocabulary words for this lesson. Pass out any glossary sheets if so desired.

Content:

Transparency 4-1 shows a wide area network (WAN) in operation to provide communications within a country or across the entire world. Refer back to Lesson Three and the use of CompuServe and/or The Source as wide area networks. List on the chalkboard or on this overhead transparency the various applications of these networks, such as electronic mail, communications between mainframes and personal computers, BBS, information utilities, CB conversation, computer teleconferencing, electronic "malls" for shopping, and securities trading.

WAN's communicate over regular **dialup** telephone lines or over separate, permanent lines between computers called **leased** lines. This transparency shows communications information being transmitted across the country using **both** telephone lines and microwave transmissions to a communications satellite in space. Information can also be sent through regular land-based telephone lines.

Transparency 4-2 lists <u>three</u> ways of providing a computer with a modem. It also shows a representation of each method.

The *first* way is to have the modem **Built-In.** The Tandy 102 is such a computer. There is a connection on the back of this laptop computer that allows the user to plug the computer directly into the telephone jack or to an acoustic coupler for use from a public telephone booth or hotel room.

The *second* way is to have the modem inside the computer, or an **Internal** modem. The Micromodem IIe by Hayse is an example of a modem combined with a serial card capability on an expansion card to fit into one of the expansion slots of an Apple IIe. The large circular object on the left side of the card is the speaker. This is used to hear for the dial tone and to check that the number is being dialed. There is a connection on the card that allows a direct connection to the telephone wall jack.
The *third* and last way to provide a computer with a modem is to have the modem **External** to the computer. Modems such as Apple's Personal Modem and the

Hayse Smartmodem are but two examples of the many available to computer users. These type of modems are placed between the computer and the telephone wall connection. They connect both to the serial connection on the computer and directly to a telephone wall jack or to a telephone line splitter.

Modems have varying capabilities. Modems fall into two capability classifications - dumb modems and smart modems. **Dumb modems** are capable only of signal conversions (digital to analog and vice versa), whereas **Smart modems** are capable of all the functions of a telephone. These are: 1) takes phone off hook; 2) senses a dial tone; 3) dials a number supplied by the computer; 4) can detect an incoming call and answer the call. No telephone is needed unless voice and data communications need to be mixed, or an operator must be used to complete the call.

Transparency 4-3 elaborates more about the the computer/modem connections. Four type of computer/modem connections are shown. **Internal or Built-in direct connect, External direct-connect, External with acoustic coupler, and Null, a direct connection between computers.** A **NULL** modem is a serial cable directly connected to the serial cards of two computers. [**CAUTION:** A common serial cable with RS-232C connectors on the ends will not work because the **null-modem adapter** crosses wires in order to send and receive information correctly. See your computer's manual for further information, or the information manual for the serial card, or lastly, call your computer technician.] These computers can be of different brands, such as an Apple IIe connected to a Tandy 1000 computer. The serial cards must be set for the correct **protocol** and the computers both must be using compatible communications software. Information can be exchanged at **9600 bps.** (This would be an amazing demonstration for the students to observe, IF one has the time and resources available.)

Local Area Networks or LAN's are networks that have a limited range or area such as a building. Peripherals such as printers and disk drives can be connected as well as PC's and mainframes computers. The transmission media can be either **twisted pairs, coaxial cable, or optical fiber.** Twisted pairs wiring already exists in buildings as part of the telephone system. This is the cheapest and most convenient. Coaxial cables are the same type of cables used for cable television. These systems are about a thousand times faster than twisted pairs. Optical fiber information is in the form of laser beams and far exceeds coaxial cables. **LAN's** use *two* types of information switching procedures - a **circuit-switched network** and **a packet-switched network.** In a circuit-switched system, equipment connects each pair of devices that wish to communicate. This system uses twisted pairs and connections are made by a central switching unit known as a *private branch exchange* or PBX. In a packet-switched system, there is no separate connections for data exchange, instead, blocks of data, packets, are sent through a fixed network shared by all communicating devices. These devices are connected to the network through a **node (terminal),** and each node is connected to the **LAN** by a network interface. Each node has a specific address for receiving and sending information.

The *configuration* of connecting cables is called **network topology.**

Transparency 4-4 shows the **BUS** topology where all nodes are connected to a common cable called a *bus*, (not to be confused with the internal bus). Packets are sent to all nodes, but only the node that the packet is addressed to can accept and process the information. Think of this arrangement as a CB network where only one person can have access to the channel at a time. To avoid two simultaneous senders on the line, a carrier has a **message collision senser** called a **Carrier Sense Multiple Access with Collision Detection** to check that there is only one sender on the line at a time. As **4-4** shows, nodes can be computers as well as peripheral devices, such as laser printers.

Transparency 4-5 shows the **RING** network topology. Packets circulate in one direction around a circular cable. Each node is connected to the cable be an interface. Packets can be removed by the node it is sent to or by the originator of the packet. Since the packets pass through each node, the system can be brought to a standstill if one interface fails. The protocol for the ring topology is **token passing.** An interface can only transmit if it has the token. Collisions are less likely to occur on a ring network. However, the data speed is much slower than the bus network.

Transparency 4-6 shows the **STAR** network topology. All packets are sent to the central switching point and then each is forwarded to its proper node. The failure of one node will not bring down the system, but a failure of the central switcher, computer 1, brings down the entire system. The main problem is that each node must be connected by a separate cable. Other networks, such as the ring, are preferred for packet-switched information.

Materials and Equipment:

One overhead projector

One thermal or paper copier (if transparencies have not been prepared previous to this time)

Transparency film and the telecommunications transparency originals

Various modems (if possible, to add realism to the lesson)
- Acoustic
- Internal - Micromodem IIe, Internal Hayes 1200-2400
- External - Apple Personal Modem, Hayes Smartmodem w/serial cards and cables
- Null modem cable and adapter

A copy of the Glossary or a listing of the communications terms to be learned for this lesson

Two Glossary Crossword Puzzles

Classroom procedures:

After discussion of this lesson, pass out the Student Study sheet for homework. This is due the following day.

For a review of all the terms, pass out the two crossword puzzles. These are due the following day.

The teacher may construct her/his own final exam for the unit, depending upon the type and amount of material covered. The teacher may wish to consider the **Mecc Study Guide** and the **MECC Flash Card** programs for use in constructing exams and practice materials.

STUDENT STUDY SHEET

Explain in detail and in your own words, the meaning of each of the following terms from Lesson Four.

Bus Topology

Local Area Network (LAN)

Network Topology

Ring Topology

Wide Area Network (WAN)

Coaxial Cable

Ring Network

Star Topology

Server

Star Network

Twisted Pair

Smart Modem

Optical Fiber

Dumb Modem

APPENDIX 1

GLOSSARY

Acoustic coupler, acoustic modem A device for sending and receiving data transmissions over a standard telephone set without connecting the modem directly to the telephone line. Acoustic couplers are used only when direct connection is impossible, as with pay telephones and with motel-room and multiline business phones.

Analog data Refers to **information** representation by means of continuously varying quantities rather than by **digital** codes. An analog watch or clock or watch, for example, represents the time by continuously varying positions of the hands.

Answer mode The mode in which a **modem** must be placed to receive calls from other computers.

ASCII code The American Standard Code for Information Interchange, a character code almost universally used by microcomputers and mini-computers. Mainframes, however, often use the **EBCDIC** code.

Asynchronous communication The transmission of one character at a time over a communication line using a start and stop bit.

Autoanswer This feature allows a modem to take the telephone off the hook when it rings and initiate communications with the caller.

Autodial A modem feature which allows the computer to dial telephone numbers, either those that are typed on the keyboard, or those sent automatically by a terminal program.

Baud A measure of the rate at which data is transmitted over a communications link. In computing (but not in communications engineering) baud is synonymous with **bits per second, (bps)** which is the preferred term.

Bit A binary digit. The smallest unit of measurement that a computer can use, corresponding to a **0** or **1**. In data transmissions, these correspond to either a high-pitched audio tone or a lower pitched one.

Buffer A holding area within your computer's memory. In communications, a buffer is used to temporarily save data so that you can recover it after it's scrolled off screen. Many terminal programs allow you to open and close buffers from the keyboard and to save their contents after your communications session, whether to a disk file or to your printer.

Bulletin board system, BBS A computer bulletin board system allows users to post messages and read messages posted by others. Data files, such as computer programs, can also be stored on and retrieved from computer bulletin boards.

Bus topology All devices in a local area network are connected to and share a single cable.

Character Any letter, number, punctuation mark, or special symbol transmitted during data communications.

Character length A communications terminal setting referring to the bits are required to transmit each character in the **ASCII** set, but in order to transmit the binary data that computers use, eight bits are required.

Coaxial cable A cable similar to that used for cable television. Computers in a **local area network** are often interconnected by coaxial cables.

Communications software Software that aids the computer user with such tasks as transferring files between computers and communicating with computer bulletin boards and information utilities.

Data bits This is the number of bits used to represent each character. The usual choices are seven and eight bits.

Digital data Refers to the representation of **information** by discrete symbols rather than continuously varying quantities. A digital clock, for example, represents the time by numbers that change abruptly from minute to minute.

Direct-connect modem A modem that is connected directly to the telephone line by plugging it into a telephone jack rather than using an **acoustic coupler** to send and receive signals through a standard telephone set. When a phone jack is available, direct connection is preferred to using an acoustic coupler.

Downloading Receiving a file from another computer and storing the file on disk for later use.

DIP (dual inline plug) Switch settings Microswitches on the Apple Super Serial card that are set to allow data transfer to different types of printers, between modems and for varying data transmission speeds.

EBCDIC Extended Binary Coded Decimal Interchange Code, a character code widely used by **mainframes. Minicomputers** and **microcomputers** usually use the **ASCII code.**

Electronic mail Refers to transmitting letters and other messages via data communications channels, combines features of both telephone calls and conventional mail. Like a telephone call, an electronic message reaches its destination almost instantly.

External direct connect modems A modem located adjacent to the personal computer and connected to the computer by a cable that plugs directly into a standard telephone jack to allow communication over telephone lines.

Framing bits Part of the bits used to send a single character of data over a telecomputing link. Framing bits delineate the beginning and end of each character.

Full duplex (channel) A communication channel that allows the transmission of data in both directions at the same time.

Half duplex (channel) A communication channel that allows the transmission of data in in either direction, but in only one direction at a time.

Internal modem A modem consisting of a printed circuit board, with the related electronics, that is installed internally in a personal computer.

Link control, channel transmission the manner in which data is exchanged between two computer systems.

Local area network (LAN) A network interconnecting computers in a restricted locality, such as a single building.

Mainframe A large computer system used by commercial information service providers, schools, and businesses. A mainframe is usually capable of handling many telecomputing sessions at one time.

Modem A device that allows a computer to send and receive data over the telephone network. (The process of converting a digital signal to an analog signal suitable for telephone transmission is called *modulation;* the reverse process, of converting an incoming analog signal back into a digital signal a computer can use, is called *demodulation.*)

Network topology This describes the pathways by which the devices on the network are connected to one another. The three most widely used network topologies are the **bus, the ring, and the star** network.

Online Connected to or accessible through a **computer system.**

Originate mode The mode in which a **modem** must be placed when used far more frequently in the originate mode than in the **answer** mode used for receiving calls.

Null modem An adaptor or cable used in connecting two computers via their **RS-232** ports. The null modem crosses certain wires so that, for example, the wire on which one computer sends data is connected to the one on which the other computer receives data, and vice versa.

Parallel the term "parallel" indicates that the eight **bits** making up each **byte** are transmitted simultaneously, in contrast to a **serial port** that transmits bits one at a time.

Parallel port A **port** normally used for connecting a printer to the computer.

Parity bit Parity bits are used for error checking. The user can choose to transmit characters with either ***even parity*** or ***odd parity.*** For even parity, the parity bit is chosen so that an even number of 1s occur in the parity and data bits. For odd parity, the parity bit is chosen so that an odd number of 1s occur in the parity and data bits. The ***parity check system*** is used to ensure the accuracy of individual characters of data sent and received by the modem.

Protocol A formal set of rules governing the format and relative timing of message exchanges between two communicating devices.

Ring network a series of computers communicating with one another and without a centralized host computer.

Ring topology All devices in a local area network are connected by a single communication cable that forms a circle.

RS-232, RS-232C A standard for transmitting data serially --- one bit at a time. An Rs-232 **port,** also called a **serial port,** can be used to connect a computer to a printer, a **modem,** or another computer. Occasionally **RS** will be seen followed by another number, indicating the use of another standard for data transmission.

Serial interface (card) A standard plug and socket with predefined connections, also called a port, used to transmit a serial stream of bits in and out of the computer.

Serial transmission The movement of one bit after another along a communication channel.

Server A computer, also called a control unit, dedicated to handling the communications need of the other computers in a local area network.

Simplex channel A communication channel that allows the transmission of data in one direction only.

Smart modems Modems, also called intelligent modems, that contain a microprocessor which controls many functions, allowing easier and more flexible use of data communications.

Star network A single, central host computer and one or more terminals or personal computers connected to it, forming a star.

Star topology Each personal computer or terminal in a local area network is connected through a central controlling communications unit.

Start and stop bits To help the receiving computer cope with the irregular rate of transmission, the code for each character must be preceded by a ***start bit*** and followed by at least one ***stop bit.***

Synchronous communication The transmission of groups of characters over a communication line without start or stop bits.

Telecommunications Another name for **data communications.**

Terminal A device that displays data received from a remote computer. Also capable of sending data typed on its keyboard to the remote computer.

Terminal program or **terminal software** Allows a microcomputer to act as a terminal.

Twisted pair Telephone wiring inside a building. Twisted pairs are sometimes used for **local area networks;** their major advantage is that they are probably already present in the building so that no new wiring need be installed for the local area network.

Uploading the transmission of data from files on the personal computer to data bases on the host computer.

Wide area network (WAN) A network interconnecting computers in widely separated locations, such as different cities, states, or countries. Because of the expense of constructing such a network, most organizations rely on the services of communications companies for wide area communications. The telephone network is often used for this purpose.

XON/XOFF A commonly used type of flow control.

APPENDIX 2

BULLETIN BOARD CODE LISTING

```
5 REM MESSAGE CENTER
8 REM
10 POKE 1013,76: POKE 1014,0: POKE 1015,3: FOR X1 = 768 TO 818: READ Y1: POKE
   X1,Y1: NEXT
20 DATA 201,190,240,3.76,201,222,32,177,0,32,227,223,32,44,213,232,189,0,2,
   208,250,134,157,138,32,82,228,160,0,145,131,200,165,113,145,131,
   200,165,114,145,131,160,2,162,0,165,157,76,226,229
50 DIM I$(100)
60 DIM BB%(100)
80 TEXT
85 GOSUB 300
97 PRINT
100 PRINT "YOUR CHOICES:"
110 PRINT : PRINT " (1) RUN PROGRAM"
120 PRINT : PRINT " (2) SEE INSTRUCTIONS"
150 PRINT : PRINT "YOUR SELECTION:";
155 GET I$: IF I$ < "1" OR I$ > "2" THEN 155
156 PRINT I$:I = VAL (I$)
160 ON I GOTO 1000,180
177 PRINT : PRINT CHR$ (4)"RUNMENU"
180 PRINT D$"RUN MC.INSTRUCTIONS"
190 PRINT D$"RUN MENU"
200 GOTO 1000
300 HOME
310 FLASH
320 PRINT " * * * * * * * * * * * * * * * * * * * * * *"
325 NORMAL
330 PRINT : PRINT
340 PRINT "WELCOME TO THE"
350 PRINT "                  EDM 310"
360 PRINT "                           ELECTRONIC"
370 PRINT "                                      BULLETIN"
380 PRINT "                                                BOARD"
382 PRINT : PRINT
385 PRINT "SYSTEM OPERATOR: R. DAUGHENBAUGH"
390 PRINT : PRINT
400 FLASH
410 PRINT "* * * * * * * * * * * * * * * * * * * * * *"
420 NORMAL
430 FOR A = I TO 555: NEXT
490 RETURN
500 REM INPUT (NO ECHO)
510 I$ = " "
520 GET J$
530 IF J$ = CHR$ (13) THEN PRINT : RETURN
590 I$ = I$ + J$: GOTO 520
600 REM INPUT
610 1$ = ""
615 EF% = 0
620 GET J$
630 IF J$ = CHR$ (13) THEN PRINT : RETURN
640 IF J$ = CHR$ (26) THEN EF% = 1: PRINT : RETURN
650 IF J$ = CHR$ (17) THEN EF% = 2: PRINT : RETURN
660 IF J$ = CHR$ (8) THEN GOSUB 700: GOTO 620
670 PRINT J$;
680 I$ = I$ + J*
690 GOTO 620
700 REM BACK SPACE
710 IF LEN (I$) = 0 THEN PRINT "";: RETURN
720 IF LEN (I$) = 1 THEN I$ = "": PRINT CHR$ (8;: CALL - 868: RETURN
730 I$ = LEFT$ (I$, LEN (I$) - 1): PRINT CHR$ (8);: CALL - 868: RETURN
1000 REM "LOG IN"
1002 HOME : PRINT
```

```
1005 PRINT "ENTER USERNAME; TYPE ? FOR HELP.": PRINT

1010 PRINT "LOGIN: ";: & GET US$
1020 IF LEN (US$) > = 4 THEN IF LEFT$ (US$,4) = "LOGO" THEN PRINT "EXIT. HAVE
     A GOOD DAY": PRINT : END
1030 IF US$ = "" THEN 1010
1040 IF LEFT$ (US$,1) = "?" THEN GOSUB 1400: GOTO 1010
1100 ONERR GOTO 1900
1110 PRINT D$"OPEN USER.";US$
1120 PRINT D$"READ USER.";US$
1130 & GET T$
1140 IF T$ < > "P" THEN PRINT D$"CLOSE": PRINT "SORRY. UNABLE TO PROPERLY READ
       USER FILE" : PRINT : GOTO 1010
1150 & GET PW$
1160 POKE 216,0
1170 PRINT D$: PRINT "PASSWORD: " GOSUB 500: IF I$ < > PW$ THEN 1800
1180 PRINT D$"READ USER."US$",B30"
1190 INPUT RP%,PP%,MP%,OP%
1200 INPUT LB,LM,EM
1203 PRINT D$
1207 IF LM = EM THEN 1260
1210 PRINT : PRINT "YOU HAVE NEW MAIL. READ IT? ";: GET I$: PRINT : IF 1$
 < >"Y" THEN 1260
1240 REM READ MAIL
1250 GOSUB 5000
1260 PRINT D$"CLOSE"
1265 IF NOT RP% THEN 1320
1270 PRINT D$"0PEN BBOARD.FILE": PRINT DS$ "READ BBOARD.FILE$: INPUT AA,BB
1285 PRINT D$
1290 IF LB > = (AA + BB) THEN 1320
1292 IF AA = 20 THEN 1320
1295 PRINT : PRINT "READ NEW POSTS ON BBOARD? ";: GET I$: PRINT : IF I$ = "N"
       THEN 1320
1300 REM READ NEW POSTS
1310 GOSUB 6000
1320 PRINT D$"CLOSE"
1330 GOSUB 2000
1340 GOTO 3000
1400 REM HELP
1405 PRINT
1410 PRINT "YOU MUST TYPE A VALID USERNAME TO GET ACCESS TO THE 'MESSAGE
CENTER'         SYSTEM. IF YOU DO NOT HAVE A USERNAME, OR YOU" :
1420 PRINT "FORGOT YOURS, CONSULT THE OWNER OR OPERATOR OF THIS APPLE.": PRINT
1430 PRINT "TYPE LOGOUT TO EXIT TO BASIC.": PRINT
1440 RETURN
1800 REM WRONG PASSWORD
1810 PRINT "INCORRECT PASSWORD."
1820 PRINT : GOTO 1010
1900 REM ONERR
1910 POKE 216,0
1915 PRINT D$"CLOSE"
1917 IF PEEK (222) < > 5 THEN PRINT "UNEXPECTED ERROR #" PEEK (222)"": PRINT :
       GOTO 1010
1920 PRINT "NO SUCH USER."
1925 PRINT D~"DELETE USER."US$
1930 PRINT : GOTO 1010
2000 REM SAVE DATA ON USE
2010 PRINT D$"OPEN USER."US$: PRINT D$"WRITE USER."U$",B30"
2020 PRINT RP%","PP%","MP%","OP%
2030 PRINT LB","LM","EM
2040 PRINT D$"CLOSE"
2050 RETURN
```

```
3000 REM MAIN MENU
3010 HOME
3020 PRINT "MESSAGE CENTER V 1.1"
3030 PRINT
3040 PRINT "YOUR CHOICES:"
3050 PRINT : PRINT " (1) READ MAIL FILE"
3060 PRINT : PRINT " (2) PURGE MAIL FILE"
3067 IF MP% THEN PRINT : PRINT " (3) SEND MAIL"
3070 IF PP% THEN PRINT : PRINT " (4) POST TO BBOARD"
3080 IF RP% THEN PRINT : PRINT " (5) READ ENTIRE BBOARD"
3095 PRINT : PRINT " (6) CHANGE YOUR PASSWORD"
3100 IF OP% THEN PRINT : PRINT " (7) PURGE BBOARD"
3110 IF OP% THEN PRINT : PRINT " (8) ADD/DELETE USERS, PRIVILEGES"
3115 PRINT : PRINT " (X) EXIT"
3120 PRINT : PRINT "YOUR CHOICE: ";: GET I$
3125 IF I$ = "X" THEN RUN
3130 I = VAL (I$): IF I < 1 OR I > 8 THEN 3000
3140 ON I GOTO 9000,11000,7000,8000,10000,14000,12000,13000
3999 END
5000 REM READ MAIL
5010 FI$ = "USER." + US$
5020 AA = LM:T% = 1
5030 GOSUB 6500
5040 LM = AA
5050 RETURN
6000 REM READ BBD (UPDATE)
6010 FI$ = "BBOARD.FILE"
6020 AA = LB
6030 PRINT D$"OPEN "F1$
6035 PRINT D$"READ "FI$
6040 INPUT XX,BB
6050 AA = AA - BB
6060 IF AA < 20 THEN AA = 20
6100 T% = 2
6110 GOSUB 6500
6120 LB = AA + BB
6130 RETURN
6500 REM READ
6510 REM F1$=FILE NAME
6520 REM AA= INIT. BYTE #
6530 NN = 0
6550 PRINT : PRINT D$"READ "FI$",B"AA
6560 & GET FR$: IF FR$ = CHR$ (5) + "$EOF" THEN RETURN
6565 NN = NN + I:BB%(NN) = AA
6570 & GET DA$: & GET TI$: & GET SU$
6580 AA = AA + LEN (FR$) + LEN (DA$) + LEN (T1$) + LEN (SU$) + 4
6590 HOME
6600 IF T% = 1 THEN PRINT "FROM "FR$" TO "US$" "DA$" "TI$
6610 IF T% = 2 THEN PRINT "POSTED-BY: "FR$" "DA$" "T1$
6620 PRINT "SUBJECT: "SU$
6630 PRINT "----------------------------------------"
6640 LC = 4
6650 & GET I$
6660 AA = AA + LEN (I$) + 1
6670 IF I$ < > CHR$ (5) + "$EOM" THEN GOSUB 6800: GOTO 6650
6680 PRINT : PRINT D$
6685 VTAB 23
6690 PRINT "NEXT? ";
6700 GET I$
6710 IF I$ = "Y" OR I$ = CHR$ (13) THEN PRINT : PRINT D$"READ "FI$: GOTO 6560
6720 IF I$ = "N" THEN PRINT : RETURN
6730 IF 1$ = "B" AND NN > 1 THEN NN = NN - 2:AA = BB%(NN + 1): GOTO 6550
6790 PRINT "";: GOTO 6700
```

```
6800 REM OUTPUT LINE
6810 PRINT 1$
6820 LC = LC + 1
6830 IF LC < 21 THEN RETURN
6835 PRINT : PRINT D$
6840 PRINT "MORE? ";
6850 GET I$
6860 IF I$ = "Y" OR I$ = CHR$ (13) THEN POP : PRINT : PRINT D$"READ "FI$: GOTO
     6590
6870 IF I$ = "N" OR I$ = "Q" THEN AA = BB%(NN): POP :PRINT : RETURN
6880 IF I$ = "B" AND NN > 1 THEN NN = NN - 2:AA = BB%(NN + 1): POP : GOTO 6550
6890 PRINT " ";: GOTO 6850
7000 REM SEND MAIL
7010 HOME : PRINT
7015 IF NOT MP% THEN PRINT "UNAUTHORIZED TO SEND MAIL.":PRINT:PRINT"HIT ANY
     KEY TO RETURN. " ;: GET I$: GOTO 3000
7020 PRINT "MAIL TO: ";: & GET MT$
7025 PRINT "DATE (MM/DD/YY): ";: & GET DA$:PRINT "TIME (HH:MM) ";: & GET TI$
7030 ONERR GOTO 7900
7040 PRINT D$"OPEN USER."MT$
7050 INPUT AA,BB,CC,DD: INPUT EE,FF,GG
7060 POKE 216,0
7070 PRINT D$
7075 PRINT
7080 PRINT "SUBJECT: ";: & GET SU$
7090 PRINT:PRINT "ENTER MESSAGE.  END WITH <CTRL-Z.     TYPE <CTRL-Q> TO
     ABORT."
7100 PRINT
7110 N=1
7120 GOSUB 600
7125 I$(N)=I$
7130 IF NOT EF%THEN N=N+1: GOTO 7120
7140 IF EF%=2 THEN PRINT:PRINT"<ABORTED. HIT ANY KEY FOR MENU.>";:GET
     I$:PRINT:PRINT D$"CLOSE":POP:GOTO 3000
7145 RETURN
7150 REM RESUME
7160 PRINT D$"WRITE USER."MT$",B"GG
7170 PRINT US$:PRINT DA$:PRINT TI$:PRINT SU$
7180 FOR A=1  TO N:PRINT I$(A):GG=GG + LEN(I$(A)) + 1 : NEXT
7190 PRINT CHR$(5);"$EOM"
7200 GG=GG+6
7210 PRINT CHR$(5)"$EOF"
7220 PRINT D$"WRITE USER."MT$",B30"
7230 PRINT AA","BB","CC","DD
7240 PRINT EE","FF","GG
7250 PRINT D$"CLOSE"
7255 PRINT "-----------------------------------"
7260 PRINT "SENT.":PRINT:PRINT "HIT ANY KEY TO CONTNUE. ";:GET I$: GOTO 3000
7900 REM ONERR
7910 POKE 216,0
7912 PRINT
7915 IF PEEK(222)=5 THEN PRINT D$"DELETE USER."MT$
7920 PRINT"NO SUCH USER.":PRINT:PRINT "HIT ANY KEY TO CONTINUE. ";:GET I$:GOTO
     3000
8000 REM POST TO BBOARD
8010 HOME :PRINT
8020 IF NOT PP% THEN PRINT"UNAUTHORIZED TO POST TO BBOARD.":PRINT:PRINT"HIT
     ANY KEY TO RETURN. ";:GET I$: GOTO 3000
8030 BF$="BBOARD.FILE"
8040 PRINT "DATE (MM/DD/YY): ";: & GET DA$
8050 PRINT "TIME (HH:MM): ";: & GET TI$
8060 PRINT D$"OPEN "BF$
8070 PRINT D$"READ "BF$
```

```
8080 INPUT AA,BB
8090 PRINT D$
8100 GOSUB 7075
8190 PRINT D$"WRITE "BF$",B"AA
8200 PRINT US$:PRINT DA$:PRINT TI$:PRINT SU$
8210 AA=AA + LEN (US$) + LEN (DA$) + LEN (TI$) + LEN (SU$) + 4
8220 FOR A = 1 TO N
8230 PRINT I$(A)
8240 AA = AA + LEN (I$(A)) + 1
8250 NEXT
8260 PRINT CHR$ (5);"$EOM"
8270 AA = AA + 6
8280 PRINT CHR$ (5)"$EOF"
8285 PRINT D$"0PEN "BF$
8290 PRINT D$"WRITE "BF$
8300 PRINT AA","BB
8310 PRINT D$"CLOSE"
8320 PRINT "----------------------------------------"
8330 PRINT "POSTED.": PRINT : PRINT "HIT ANY KEY TO CONTINUE. ";: GET I$: GOTO
     3000
9000 REM READ MAIL
9005 PRINT
9010 F1$ = "USER." + US$
9020 T% = 1:AA = 60
9030 PRINT D$"0PEN "FI$
9040 GOSUB 6500
9050 PRINT D$"CLOSE "F1$
9060 GOTO 3000
10000 REM READ BBOARD
10002 IF NOT RP% THEN PRINT "NOT AUTHORIZED TO READ BBOARD. ": PRINT : PRINT
      "HIT ANY KEY TO CONTINUE. ";: GET I$: GOTO 3000
10005 PRINT
10010 FI$ = "BBOARD.FILE"
10020 T% = 2
10030 AA = 20
10040 PRINT D$"OPEN "F1$
10050 GOSUB 6500
10060 PRINT D$"CLOSE "F1$
10070 GOTO 3000
11000 REM PURGE MAIL
11010 HOME : PRINT : PRINT "THIS WILL DELETE ALL MAIL MESSAGES. DO YOU WANT TO
      DO THIS? ";: GET I$: PRINT
11020 IF I$ < > "Y" THEN 3000
11030 PRINT : PRINT "DELETING MESSAGES..."
11040 PRINT D$"DELETE USER."US$
11050 PRINT D$"OPEN USER."US$
11055 PRINT D$"WRITE USER."US$
11060 PRINT "P": PRINT PW$
11064 PRINT D$"WRITE USER."US$",B60": PRINT CHR$ (5)"$EOF"
11068 LM = 60:EM = 60
11070 GOSUB 2000
11080 PRINT "DONE."
11090 PRINT : PRINT "HIT ANY KEY TO CONTINUE. ";: GET I$: GOTO 3000
12000 REM PURGE BBOARD
12005 HOME : PRINT
12010 IF NOT OP% THEN PRINT "UNAUTHORIZED. OPERATOR PRIVILEGES ARE REQUIRED.":
      PRINT:PRINT "HIT ANY KEY TO CONTINUE. ";: GET I$: GOTO 3000
12020 PRINT "THIS WILL DELETE ALL MESSAGES ON THE BBOARD. DO YOU WANT TO DO
      THIS? ";: GET I$:PRINT
12030 IF I$ < > "Y" THEN 3000
12040 PRINT "DELETING MESSAGES..."
12050 PRINT D$"0PEN BBOARD.FILE"
12060 PRINT D$"READ BBOARD.FILE"
```

```
12070 INPUT AA,BB
12080 BB = BB + (AA - 20)
12090 PRINT D$"DELETE BBOARD.FILE"
12100 PRINT D$"0PEN BBOARD.FILE"
12110 PRINT D$"WRITE BBOARD.FILE"
12120 PRINT 20","BB
12130 PRINT D$"WRITE BBOARD.FILE,B20"
12140 PRINT CHR$ (5)"$EOF"
12150 PRINT D$"CLOSE"
12160 GOTO 3000
13000 REM ALTER USERS
13010 HOME : PRINT
13020 IF NOT OP% THEN PRINT "UNAUTHORIZED. OPERATOR PRIVILEGES ARE REOUlRED TO
      DO THIS.":PRINT : PRINT "HIT ANY KEY TO CONTINUE. ";: GET I$: GOTO 3000
13030 PRINT "EDIT USER DATA:"
13040 PRINT
13050 PRINT "YOUR CHOICES:"
13060 PRINT : PRINT " (1) ADD NEW USER"
13070 PRINT : PRINT " (2) REMOVE USER"
13080 PRINT : PRINT " (3) ALTER PRIVILEGES"
13086 PRINT : PRINT " (X) RETURN TO MAIN MENU"
13090 PRINT : PRINT "YOUR CHOICE ~ GET I$:I = VAL (I$)
13093 IF I$ = "X" THEN 3000
13096 IF I < 1 OR I > 3 THEN 13000
13100 ON I GOTO 13200,13400,13600
13200 REM ADD USER
13210 HOME : PRINT
13220 PRINT "NEW USERNAME: "; :& GET U$
13225 IF U$ = "" THEN 13000
13230 PRINT "INITIAL PASSWORD: ";: & GET P$
13240 PRINT : PRINT "PRIVILEGES (O=NO, 1=YES):"
13250 INPUT "READ BBOARDS? ":B%
13260 INPUT "POST TO BBOARDS? ":P%
13270 INPUT "SEND MAIL? ":M%
13280 INPUT "OPERATOR? ";O%
13290 PRINT
13300 PRINT D$"0PEN USER."U$
13310 PRINT D$"WRITE USER."U$
13320 PRINT "P": PRINT P$
13330 PRINT D$"WRITE USER."U$",B30"
13340 PRINT B%","P%","MP%","0%
13350 PRINT "20,60,60"
13360 PRINT D$"WRITE USER."U$",B60"
13370 PRINT CHR$ (5):"$EOF"
13380 PRINT D$"CLOSE"
13390 PRINT "DONE. HIT ANY KEY. ";: GET I$
13395 GOTO 13000
13400 REM REMOVE USER
13410 HOME : PRINT
13420 PRINT "USER TO DELETE: ";: & GET U$
13430 PRINT D$"0PEN USER."U$
13440 PRINT D$"DELETE USER."U$
13450 PRINT : PRINT "DONE. HIT ANY KEY. ";: GET I$
13460 GOTO 13000
13600 REM ALTER PRIVILEGES
13610 HOME : PRINT
13620 PRINT "USER NAME: ";: & GET U$
13630 ONERR GOTO 13900
13640 PRINT D$"OPEN USER."U$
13650 PRINT D$"READ USER."U$",B30"
13660 INPUT R,P,M,O
13670 INPUT AA,BB,CC
13680 PRINT D$
```

```
13690 POKE 216,0
13700 PRINT : PRINT "PRESENT PRIVILEGES:"
13710 PRINT
13720 PRINT " READ BBOARDS = ";R
13730 PRINT " POST TO BBOARDS = ";P
13740 PRINT " SEND MAIL = ";M
13750 PRINT " OPERATOR = ";O
13760 PRINT : PRINT "(O=OFF, 1=ON)"
13770 PRINT : PRINT "ENTER NEW PRIVILEGES:"
13780 PRINT : INPUT "READ BBOARDS = ";R
13790 INPUT "POST TO BBOARDS = ";P
13800 INPUT "SEND MAIL = ";M
13810 INPUT "OPERATOR = ";O
13820 PRINT : PRINT D$"WRITE USER."U$",B30"
13830 PRINT R","P","M","O
13840 PRINT AA"."BB","CC
13850 PRINT D$"CLOSE"
13860 PRINT "DONE. HIT ANY KEY. ";: GET I$: GOTO 13000
13900 REM ONERR
13910 POKE 216,0
13920 IF PEEK (222) = 5 THEN PRINT : PRINT D$"DELETE USER."U$
13930 PRINT "NO SUCH USER. HIT ANY KEY. ";: GET I$: GOTO 13000
14000 REM CHANGE PASSWORD
14010 HOME : PRINT
14020 PRINT "ENTER OLD PASSWORD: ";: GOSUB 500: IF I$ < > PW$ THEN 3000
14030 PRINT : PRINT "ENTER NEW PASSWORD: ";: GOSUB 500:P$ = I$
14040 PRlNT "ENTER IT AGAIN: ";:GOSUB 500: IF P$ <> I$ THEN PRINT : PRINT
      "TRY IT OVER." : GOTO 14030
14050 PW$ = P$
14060 PRINT D$"0PEN USER."US$
14070 PRINT D$"WRITE USER."US$
14080 PRINT "P": PRINT PW$
14090 PRINT D$"CLOSE"
14100 GOTO 3000
```

APPENDIX 3

ONLINE NETWORKS

A. Networks

1. **AppleLink** (Personal Edition)
   (800) 545-5047
   ^ $35/yr (waived first year)

300-2400 baud	
*	$.10/min
+	$.25/min

2. **BIX**
   (800) 227-2983
   ^ $39(one-time)

300-2400 baud	Tymnet
* $9/hr	$2/hr
+ $12/hr	$8/hr

3. **CompuServe**
   (800) 848-8199
   (614) 457-8600
   ^ $39.95 (one-time)

300	1200-2400 baud
* $6/hr	$12.50/hr
+ $6/hr	$12.50/hr

4. **Dow Jones News/Retrieval**
   (800) 257-5114
   (609) 452-1511
   ^ $29.95 (indiv.); $49.95 (bus.);
   annual service fee after firstyear; $12

300-2400 baud	
*	$.10-$3.25/min
+	$.10-$3.25/min

5. **GEnie**
   (800) 638-9636
   (301) 340-4000
   ^ $29.95 (one time)

300-1200	2400 baud
* $5-$10/hr	$12.50-$17.50/hr
+ $35/hr	$42.50/hr

KEY ^ Registration/Subscription fee * Evening/Weekend Rates + Day Rates

6. **KNOWLEDGE-INDEX**
   (800) 334-2564
   (415) 858-3785
   ^ $35 (included two free hours)
   300-2400 baud
   * $24/hr
   + $24/hr

7. **NEWSNET**
   (800) 345-1301
   (215) 527-8030
   ^ $120/yr

	300-1200	2400 baud
*	$60/hr	$90/hr
+	$60/hr	$90/hr

8. **PEOPLE LINK ("PLINK")**
   (800) 524-0100
   (312) 648-0660
   ^ $15 (one hour free connect time)

	300	1200	2400 baud
*	$4.95	$4.95	$11.95
+	$11.95	$12.95	$14.95/hr

9. **The Source**
   (800) 336-3366
   (703) 734-7500
   ^ $29.95 (one time)

	300	1200	2400 baud
*	$.14	$.18	$.20/min
+	$.36	$.43	$.46/min

10. **The WELL**
    Whole Earth Lectronic Link
    (415) 332-4335
    ^ $8/mo
    300 2400 baud
    * $3/hr
    + $3/hr

KEY ^ Registration/Subscription fee * Evening/Weekend Rates + Day Rates

THE STATE OCCUPATIONAL INFORMATION COORDINATING COMMITTEE

Bell Bldg., Room 400
207 Montgomery Street
Montgomery, AL 36130
(205) 261-2990

INTRODUCTION

SOICC is a computerized system which provides its users with current and accurate occupational and career information.

This information is provided through the following ten (10) computerized files:

State Occupational File (SOCC)
State Scholarship and Financial Aid File (SAID)
State Occupational Training File (SOTF)
Job Bank Summary File (JOBS)
National Occupational File (OCCU)
National Scholarship and Financial Aid File (AIDS)
Two-Year College File (COL2)
Four-Year College File (COL4)
Armed Services Occupational File (ASOC)
Graduate and Professional School File (GRAD)

The information available through SOICC can be obtained by two (2) methods. Those methods are the **SEARCH METHOD** and the **DIRECT METHOD.**

The **SEARCH METHOD** is used when an individual does not have a specific occupation, college, training institution, etc., in mind but wants to specify certain personal characteristics and interests in exploring occupations, colleges, etc., that meet the individual's criteria. The SEARCH METHOD may be used with all files.

The **DIRECT METHOD** is used when a person has a specific occupation, college, etc., in mind. The **DIRECT METHOD** may be used with all files with the exception of the State Scholarship and Financial Aid File (SAID).

You will find sample printouts of all the files in the "FILE PREVIEW SECTION" of this manual. Please study the printouts so that you will be familiar with the type information you will receive from each of the files. Also, you wil find a list of commands in the "TERMINAL COMMAND SECTION". The commands will be used through the SOICC files to access occupational and career information. After studying these section, you will be ready to go into the "DIRECT METHOD SECTION" and the "SEARCH METHOD SECTION" and access the data you desire.

APPENDIX 4

COMMUNICATIONS SOFTWARE

Apple format:

Public domain software:

Electronic Bulletin Board and Simulation - see Appendix 2 for the program or code listing.

Commercial software:

The Electronic Village. Exzys 2728 23rd Street, Greeley, CO, 8063. 303-330-8021.

Crossword Magic. Mindsacape, Inc. 3444 Dundee Road, Northbrook, IL 60062.

MECC (Minnesota Educational Corporation).
3490 Lexington Ave N
St. Paul, MN 55126

Flash Card
Study Guide

IBM format:

Shareware software:

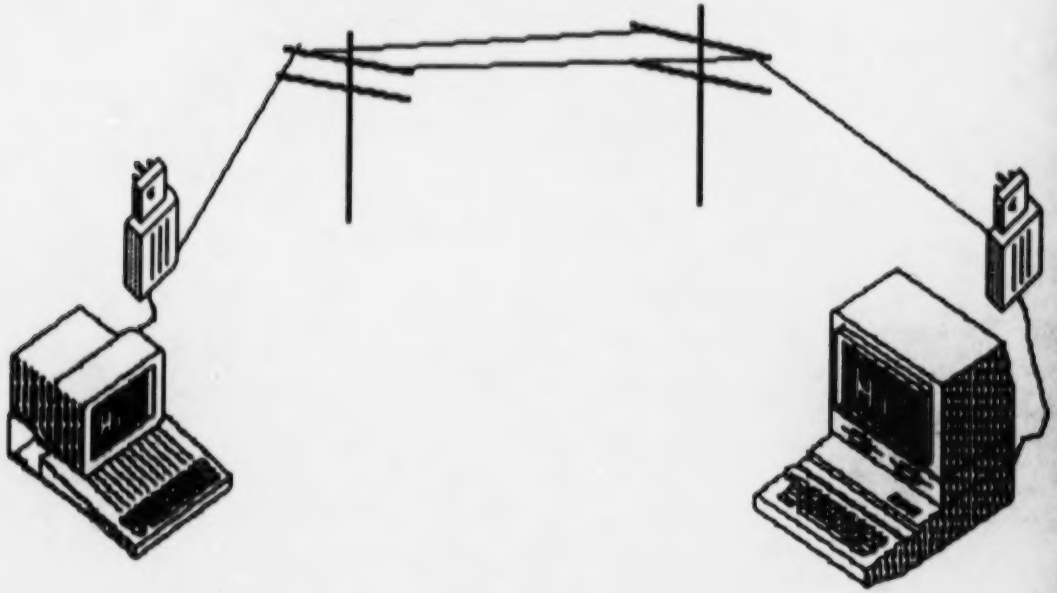
Telecommunications Simulation - one diskette - Program concept by Dan Davidson, written by Mike Fisher.

PC Board - 2 diskettes (harddrive **strongly** recommended) - by:
Archive Utility, version 5.10, copyrighted by System Enhancement Associates. Refer all inquiries to:
System Enhancements Associates
21 New Street
Wayne, NJ 07470

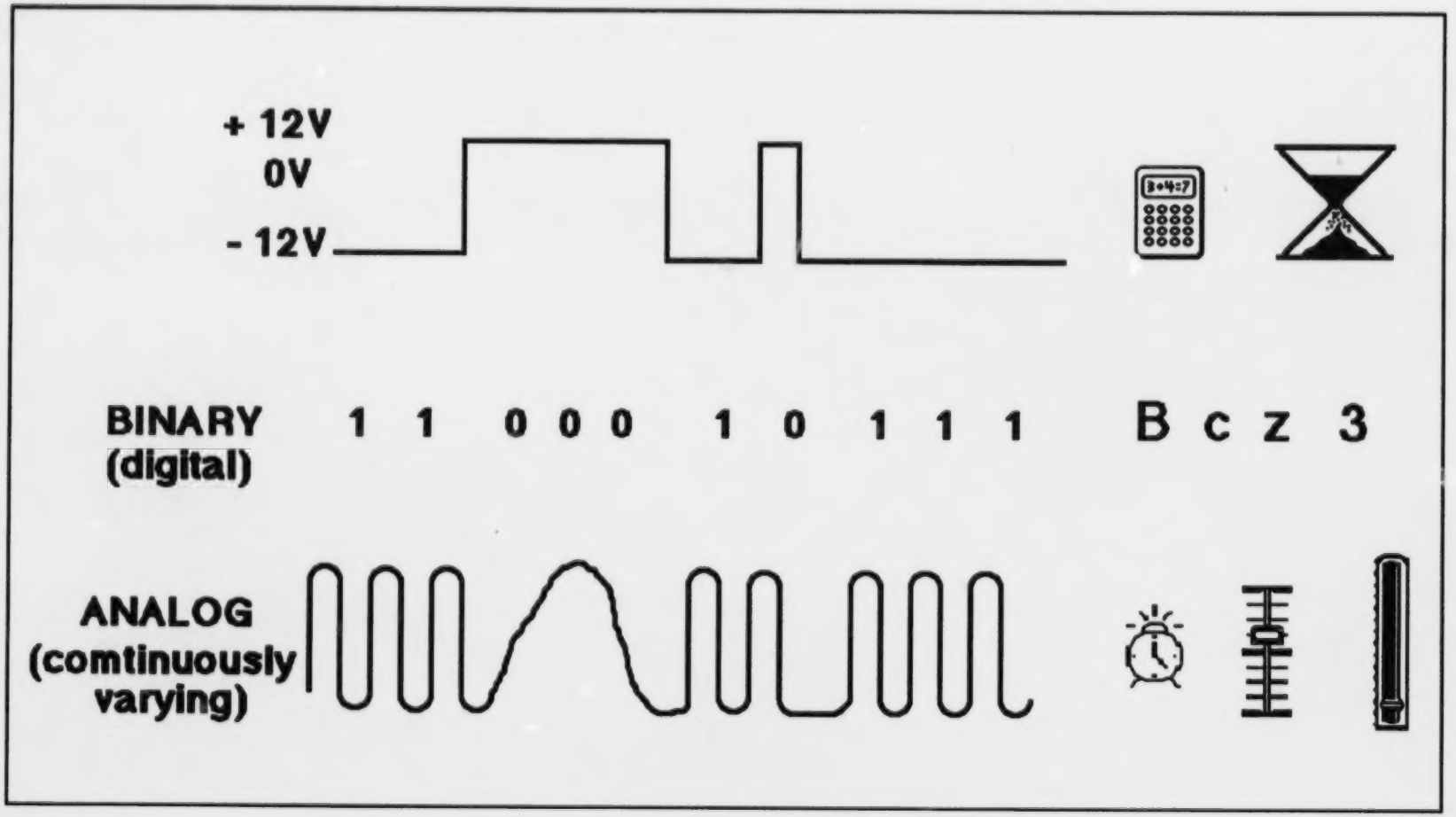
APPENDIX 5

TRANSPARENCY MASTERS

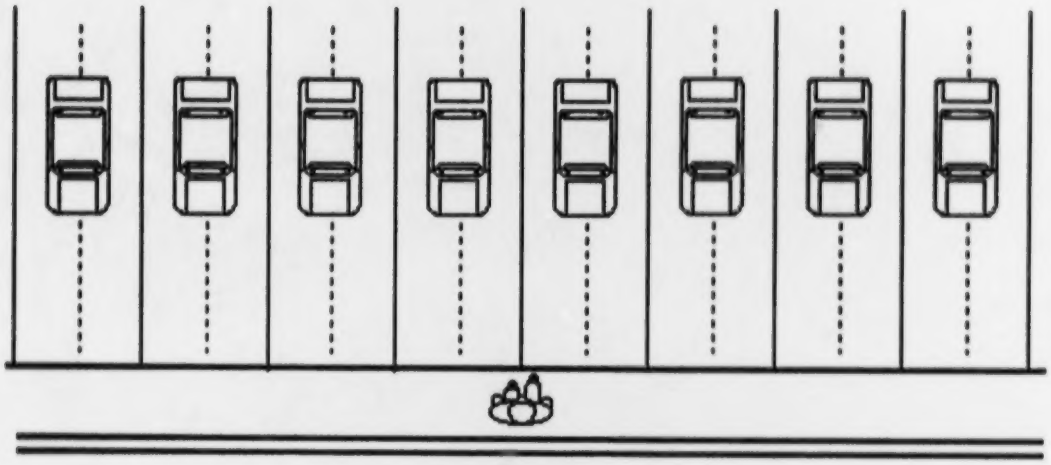
TELECOMMUNICATING



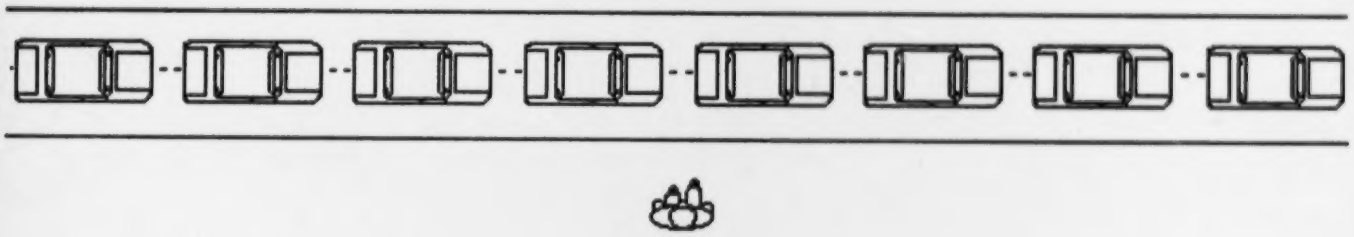
DIGITAL MODULATION



PHYSICAL CONTROL OF DATA TRANSFER



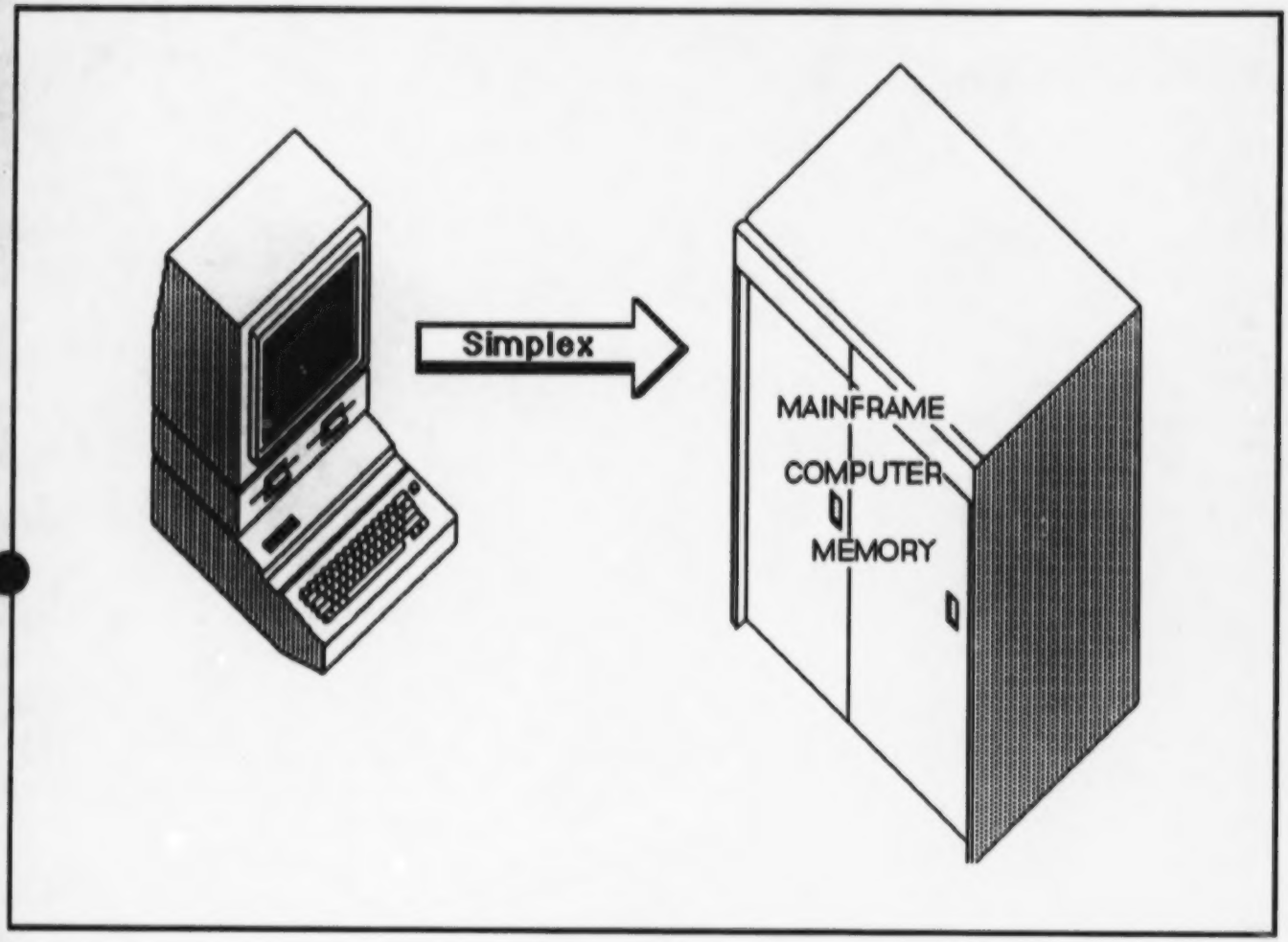
PARALLEL



SERIAL

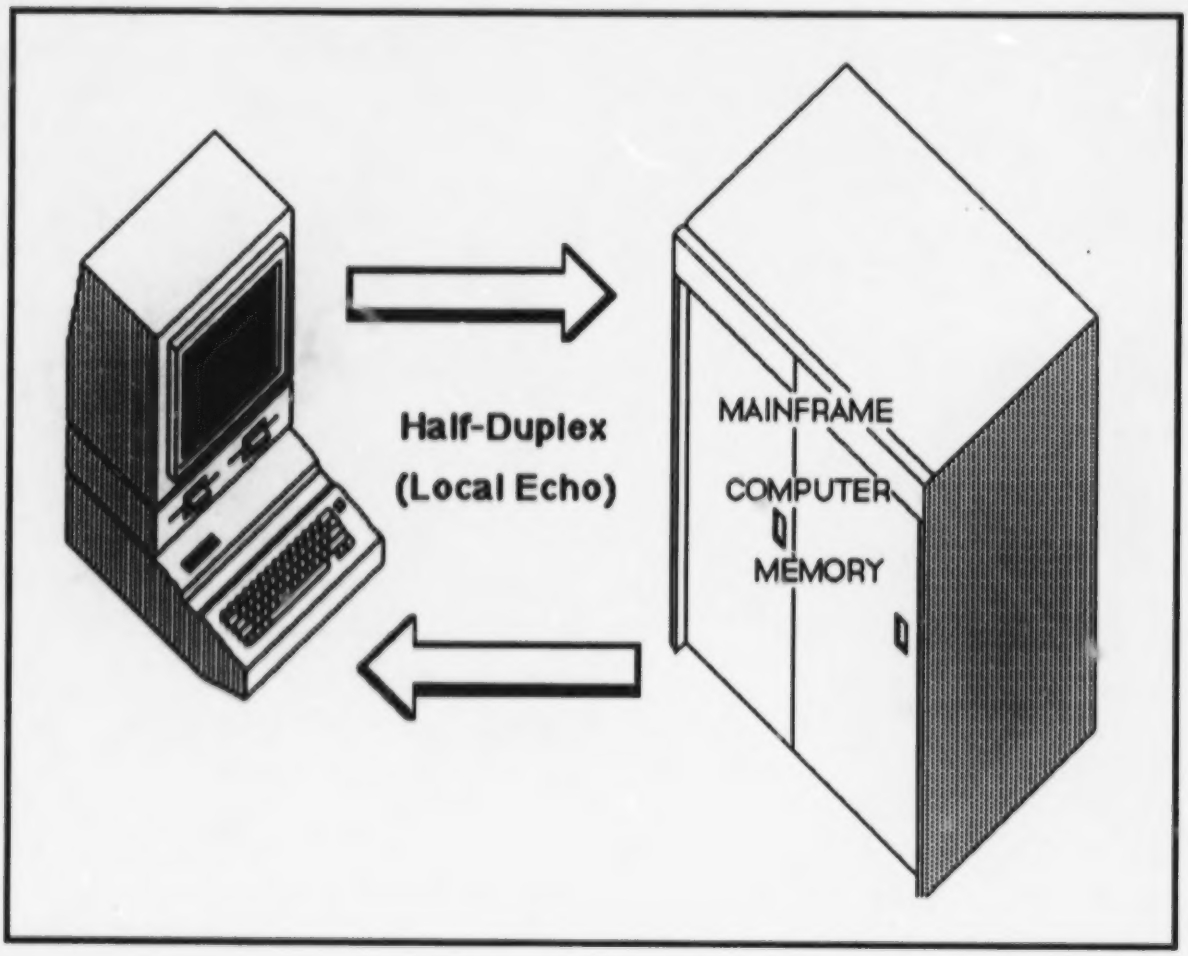
1-3

COMMUNICATION CHANNEL TRANSMISSION



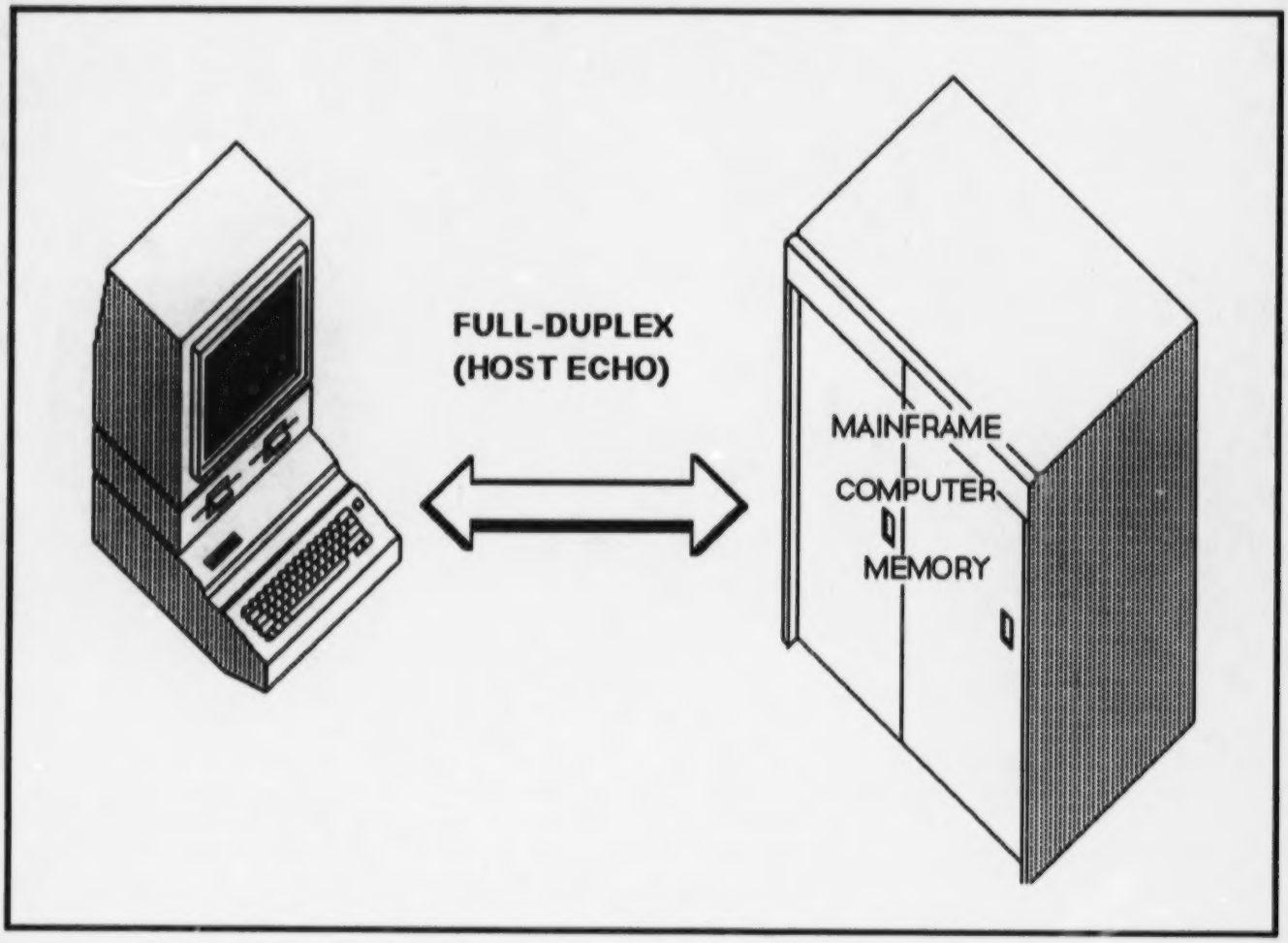
1-4

COMMUNICATION CHANNEL TRANSMISSION



1-5

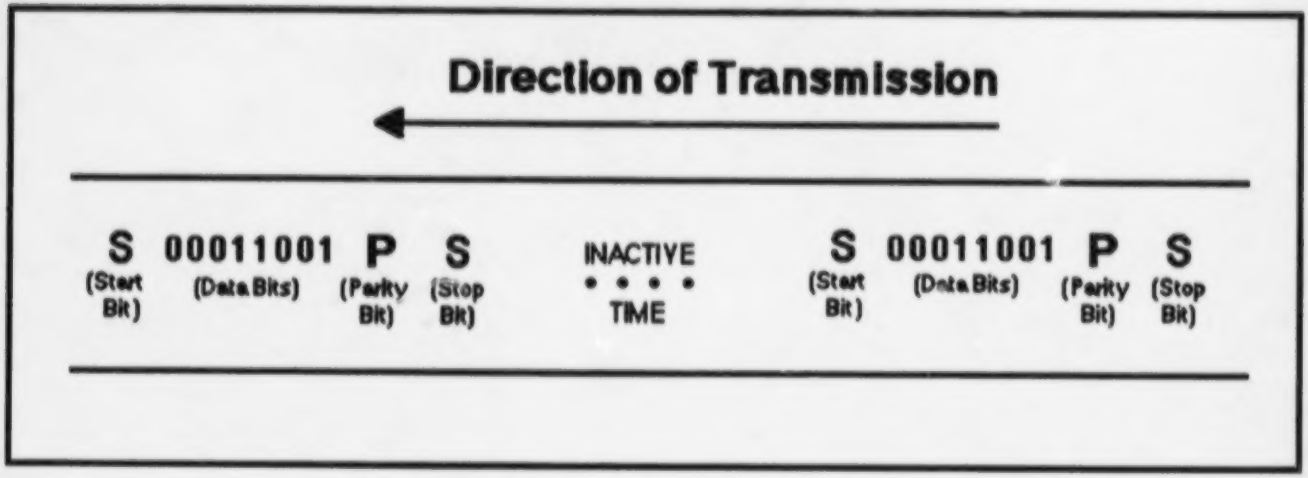
COMMUNICATION CHANNEL TRANSMISSION



1-6

DATA TRANSMISSION PATTERN

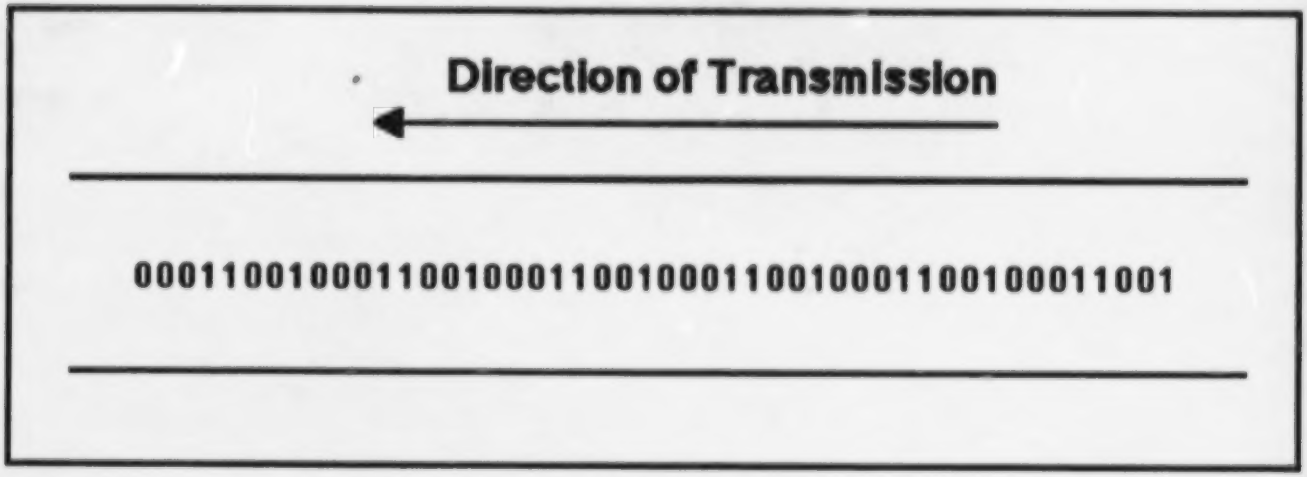
ASYNCHRONOUS



2-1

DATA TRANSMISSION PATTERN

SYNCHRONOUS



PARITY BIT

1. Performs error detection
2. Single bit errors flagged
3. Roughly 95% effective
4. Types:

   Odd Even None

START AND STOP BITS

1. Low voltage noise
2. Change in line frequency alterts computer
3. Faulty bits ignored
4. Less than 300 baud requires two stop bits

DATA TRANSMISSION SPEED

*SPEED	TIME
300 bps	55.6
1200 bps	13.9
2400 bps	7.0
9600 bps	1.8

*Transmission of 100,000 bytes at each of the four transmission speeds.

ASYNCHRONOUS CARD FUNCTIONS

ADDS START/STOP BITS TO TRANSMISSIONS

STRIPS START/STOP BITS FROM RECEIPTS

MONITORS LINK WITH MODEM

REGULATES BAUD RATE

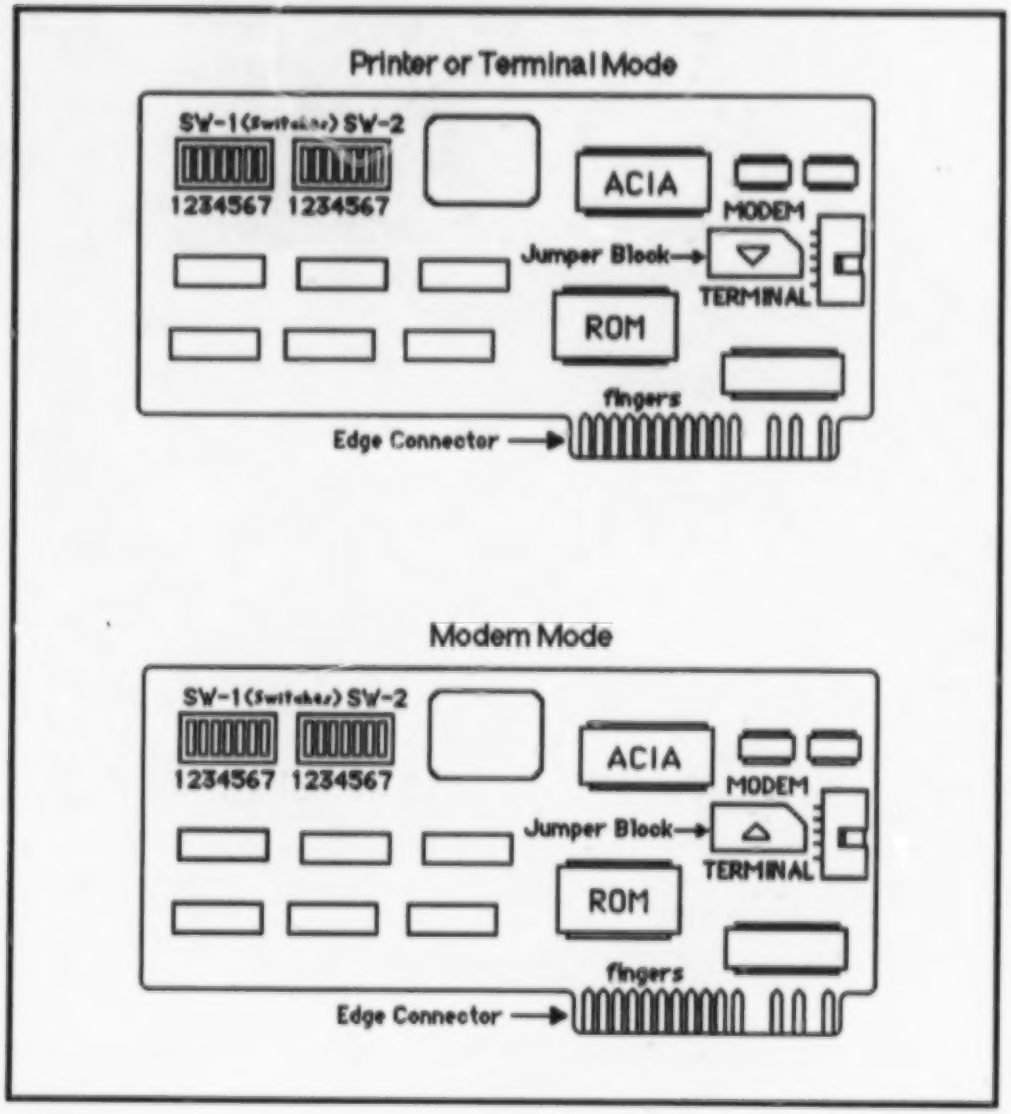
ADDS PARITY BITS

DETECTS FALSE START BITS

CHECKS FOR PARITY ERRORS

MAY INCLUDE BUFFER

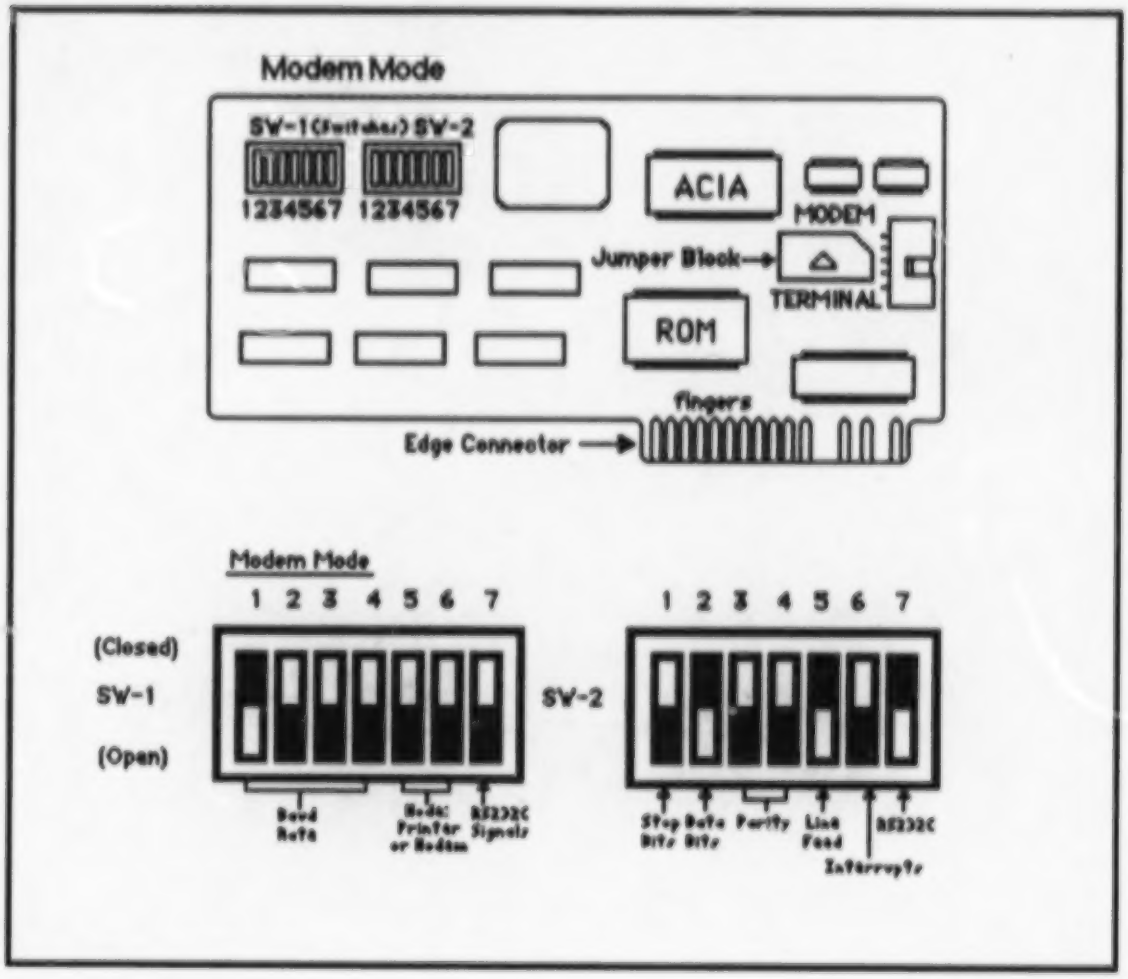
Apple Super Serial Card



2-6

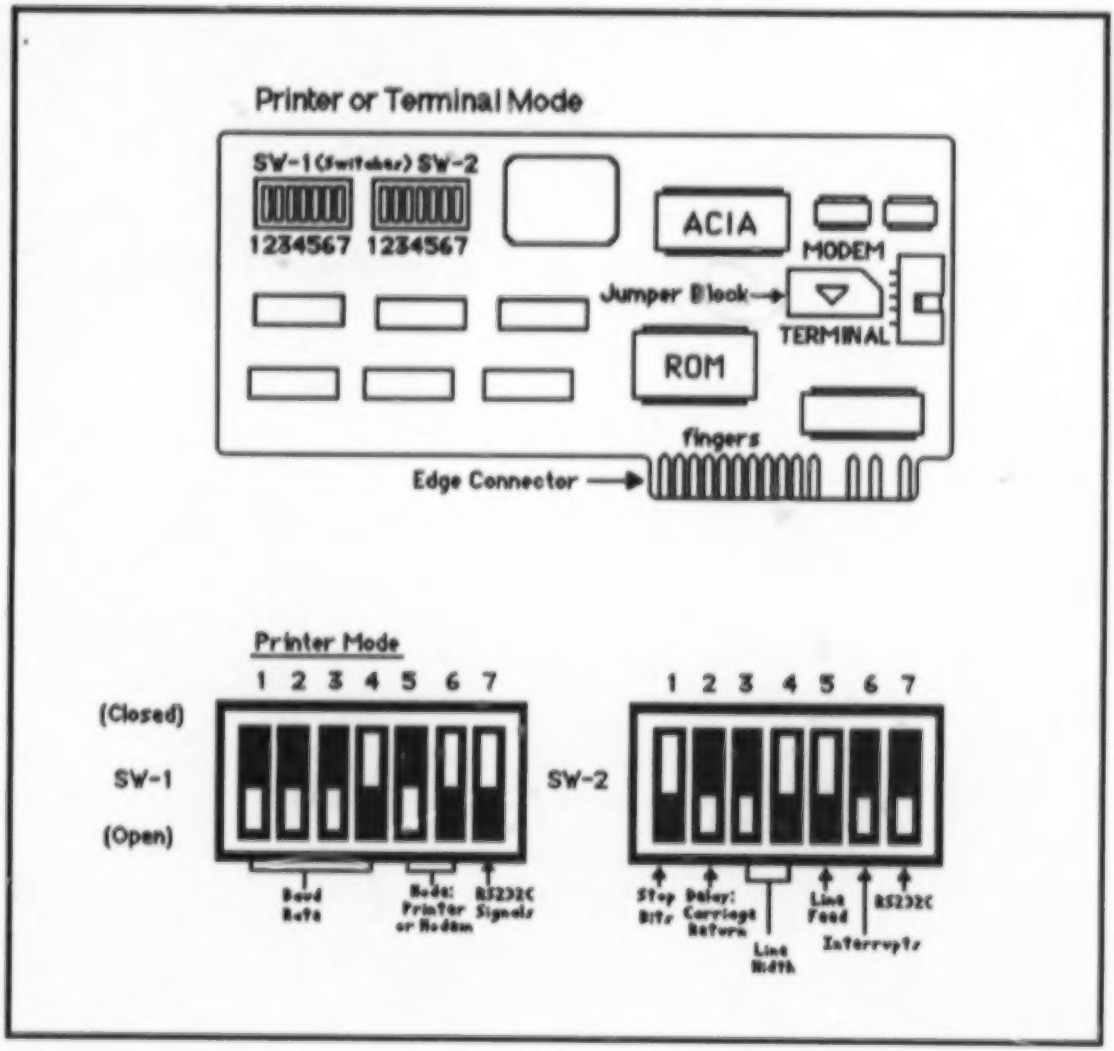
APPLE SUPER SERIAL CARD:

MODEM SWITCH SETTINGS

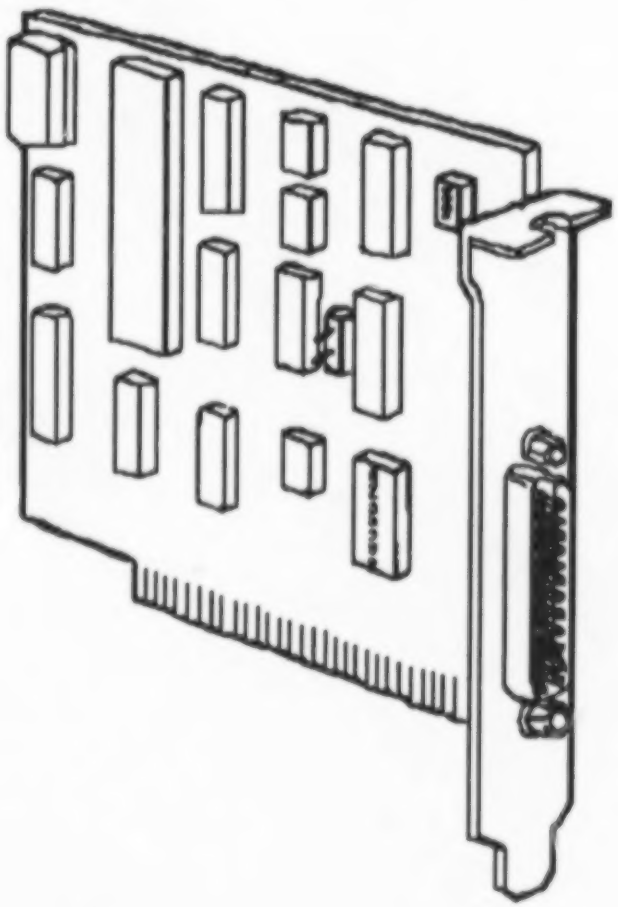


2-7

APPLE SUPER SERIAL CARD:
PRINTER SWITCH SETTINGS



ASYNCHRONOUS COMMUNICATIONS ADAPTER FOR MS DOS COMPUTERS

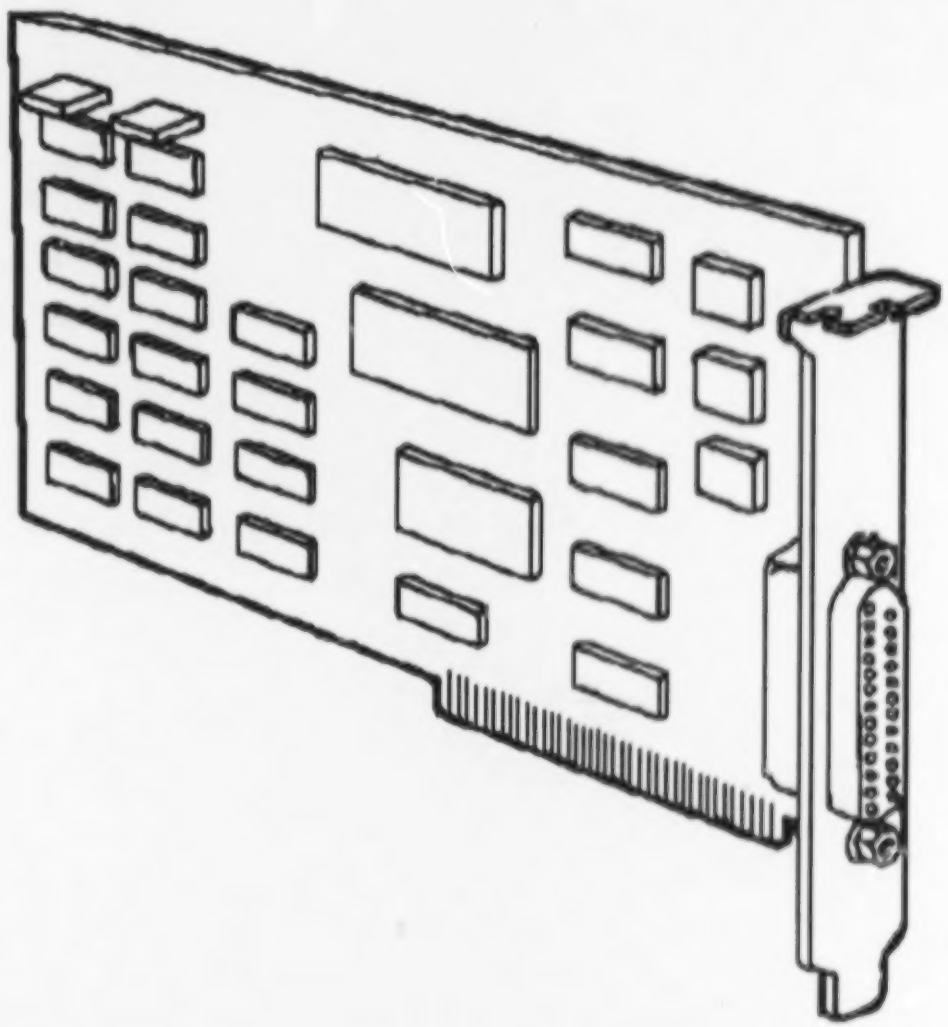


2-9

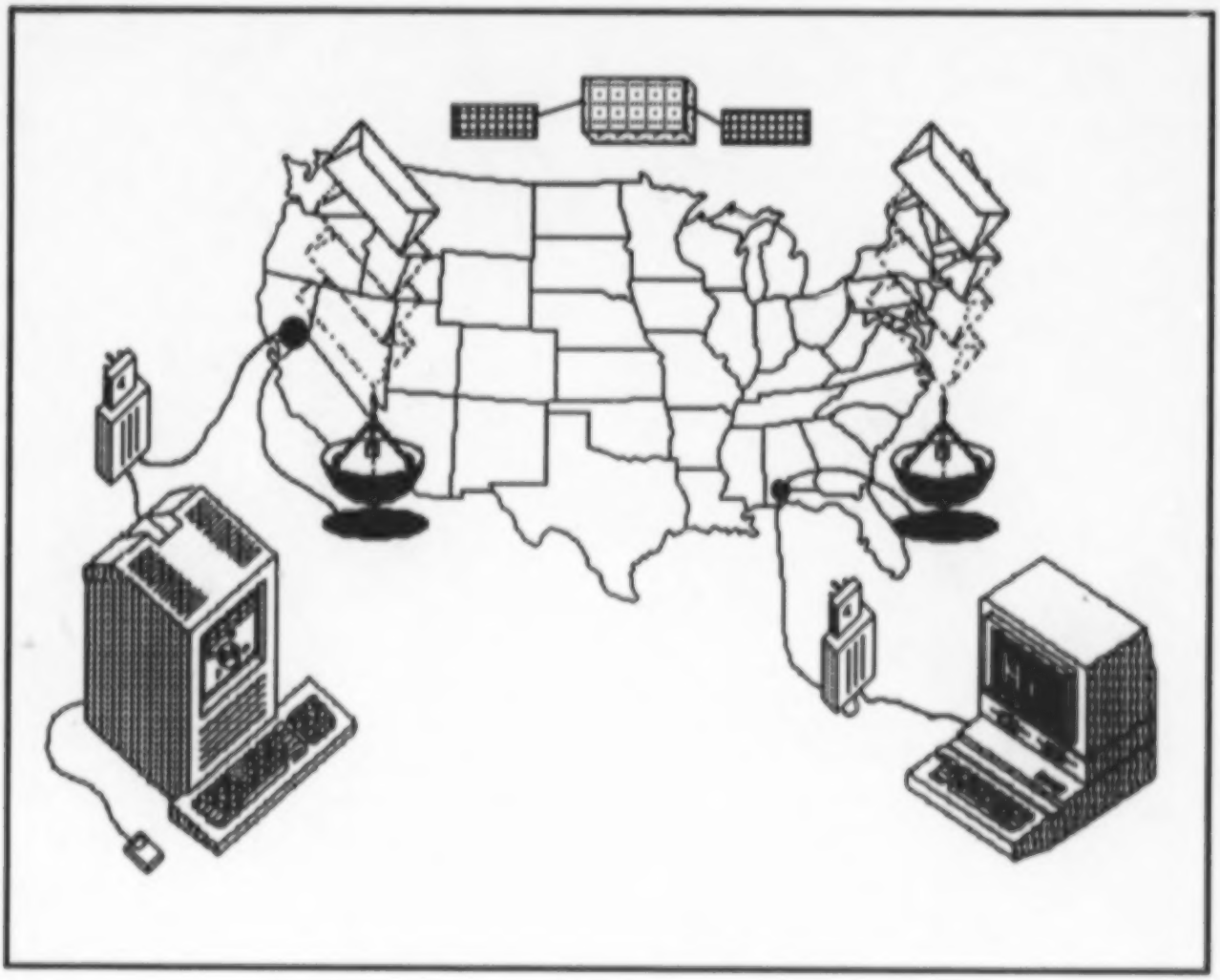
APPLE IIC

2-10

SYNCHRONOUS DATA LINK CONTROL ADAPTER FOR MS DOS

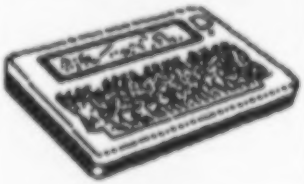
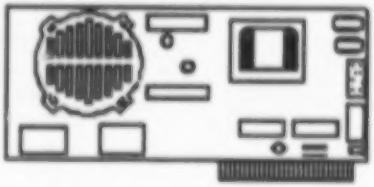


WIDE AREA NETWORK

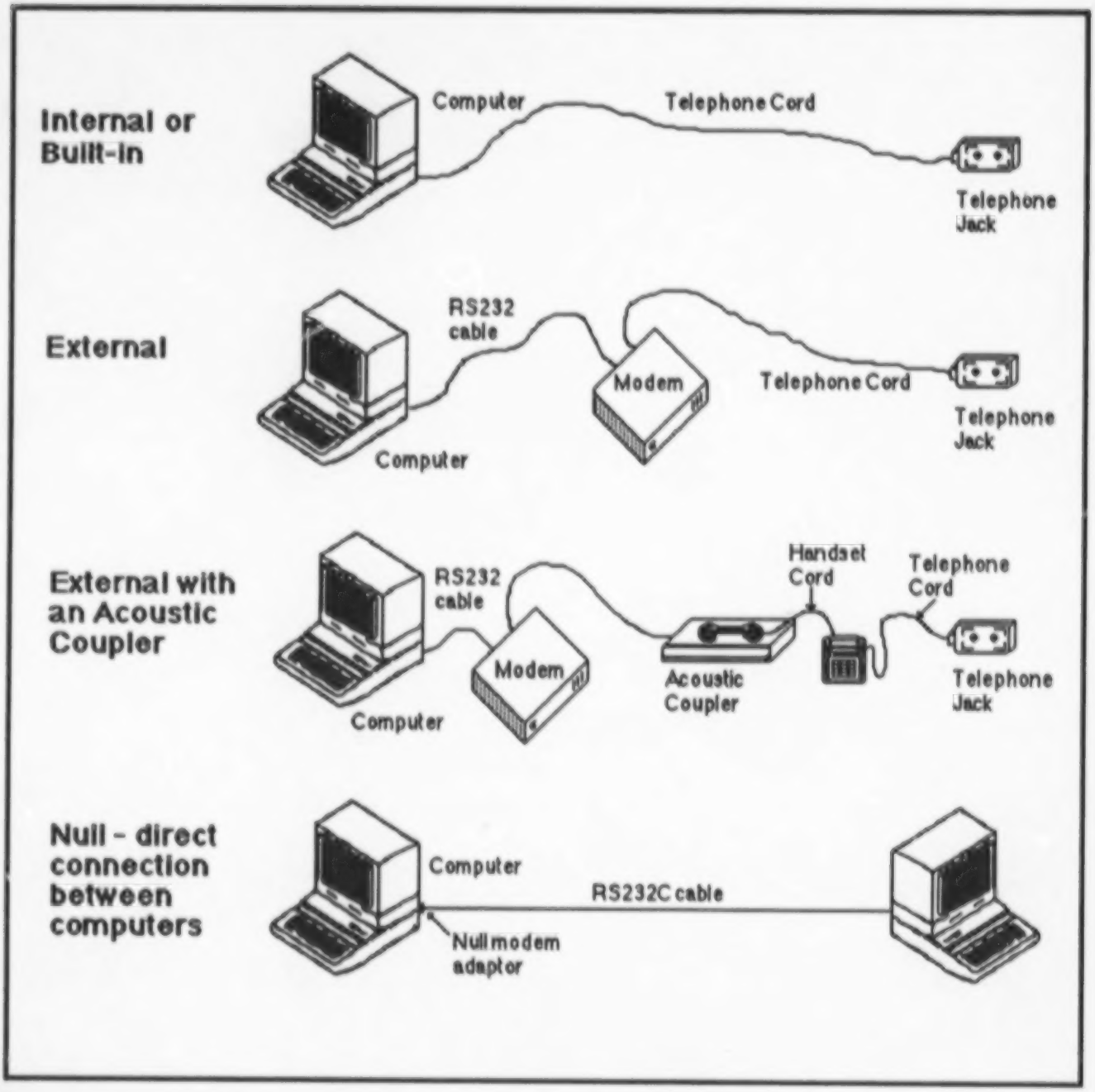


4-1

PROVIDING A COMPUTER WITH A MODEM

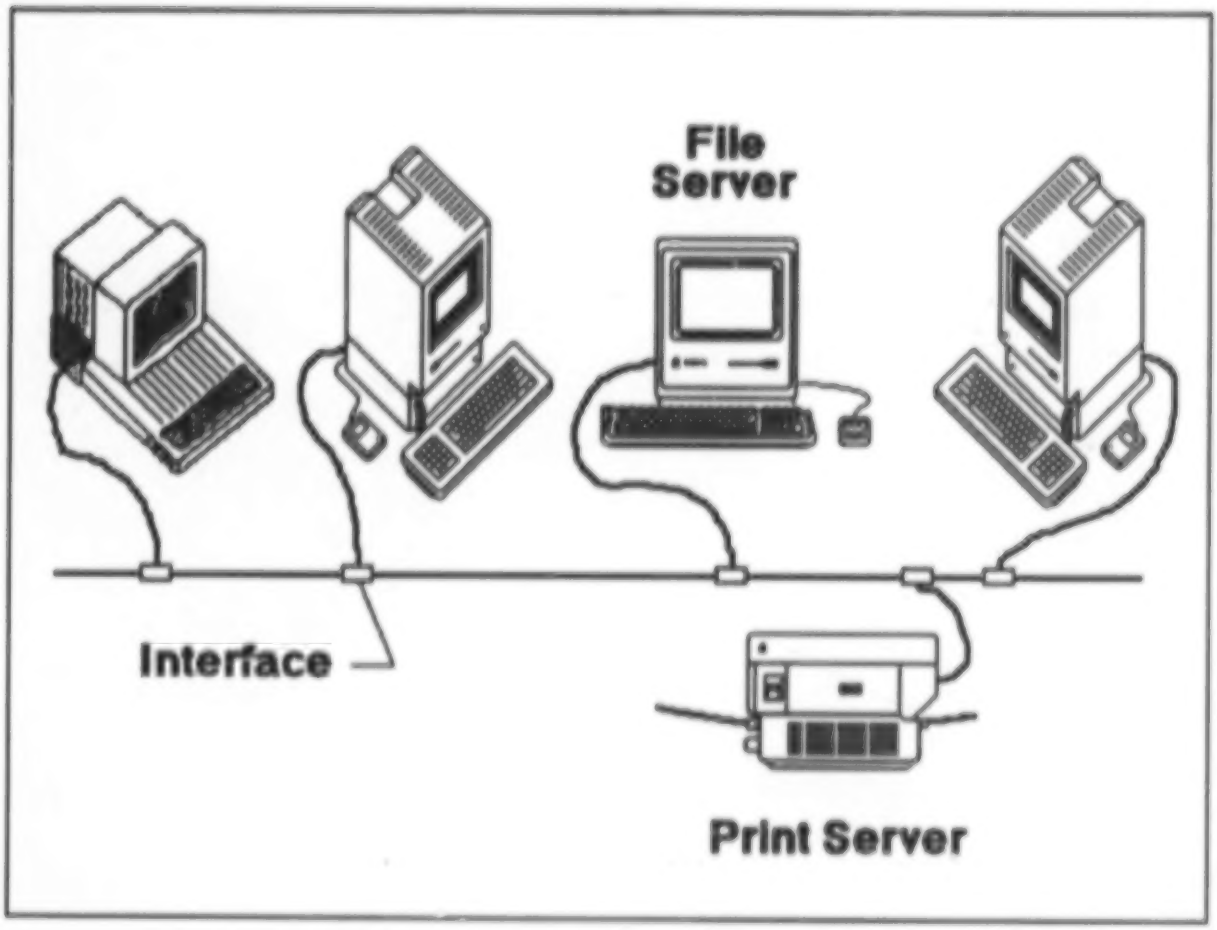
BUILT-IN	INTERNAL	EXTERNAL
Built Into Computer Tandy 102	Micromodem IIe (modem and serial card built into an expansion card)	Smartmodem Apple Personal Modem
Connects to an Acoustic Coupler Or Directly to a Telephone Jack	Connects to a Telephone Wall Jack	Connects to the serial connection and the telephone line
		

TYPES OF COMPUTER/MODEM CONNECTIONS



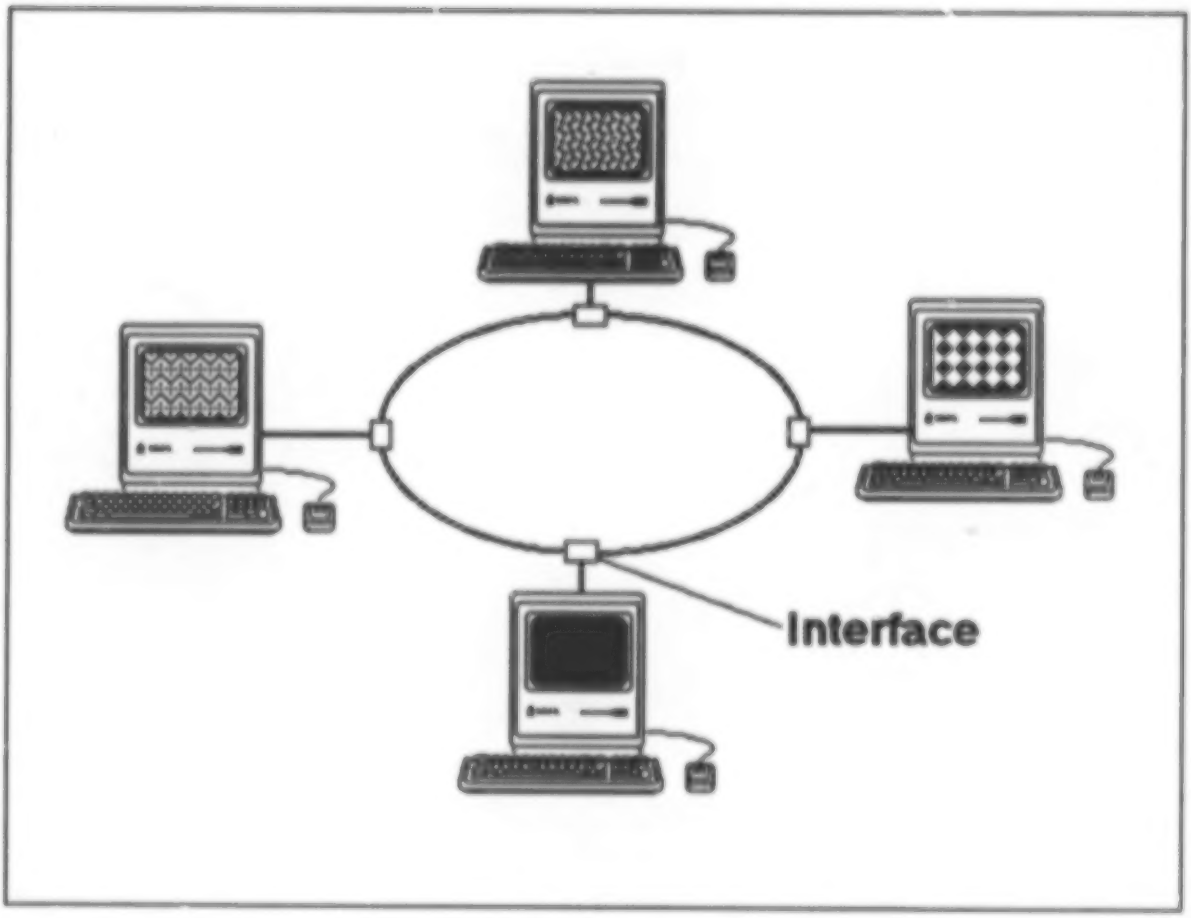
LOCAL AREA NETWORK

BUS

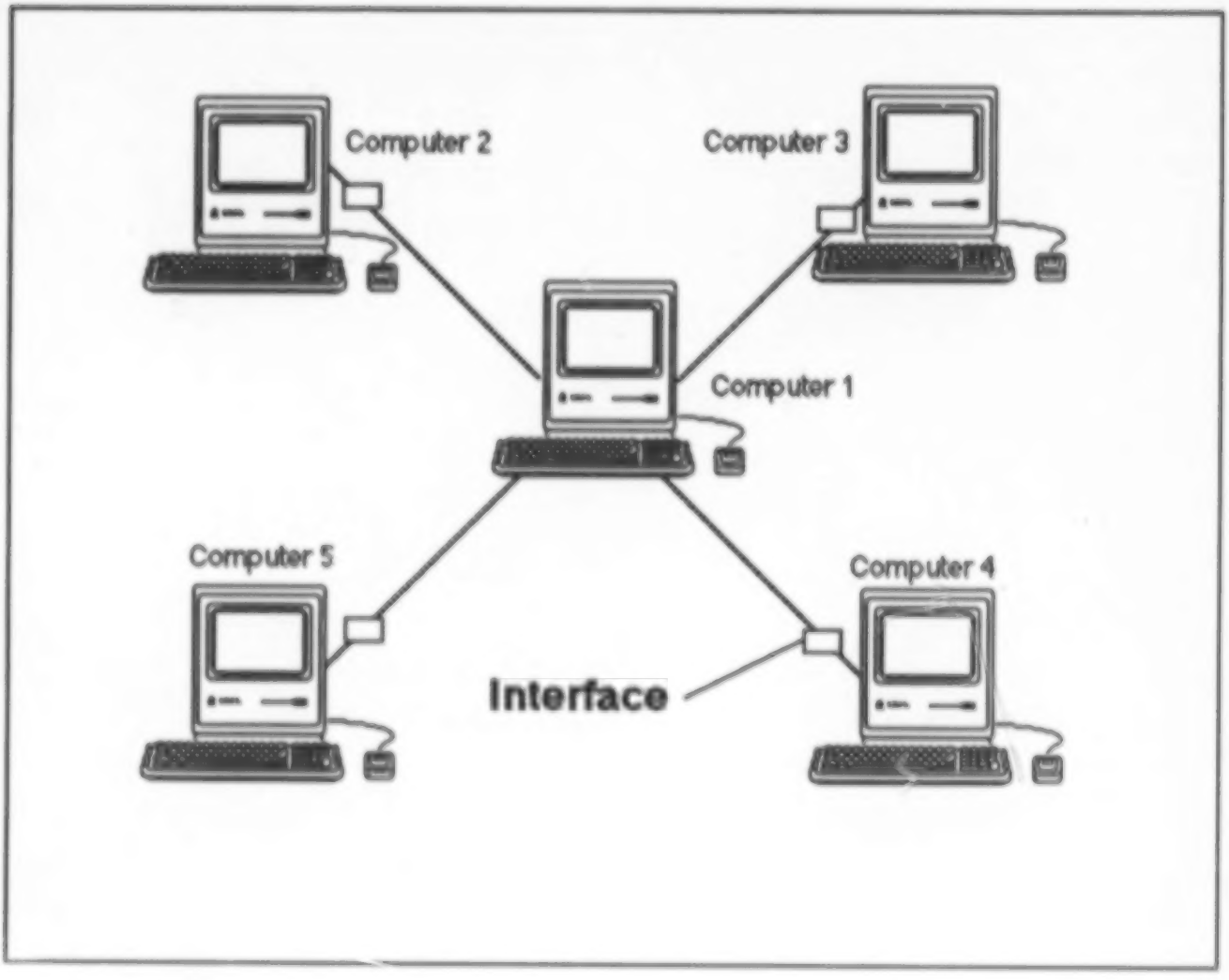


4-4

RING NETWORK

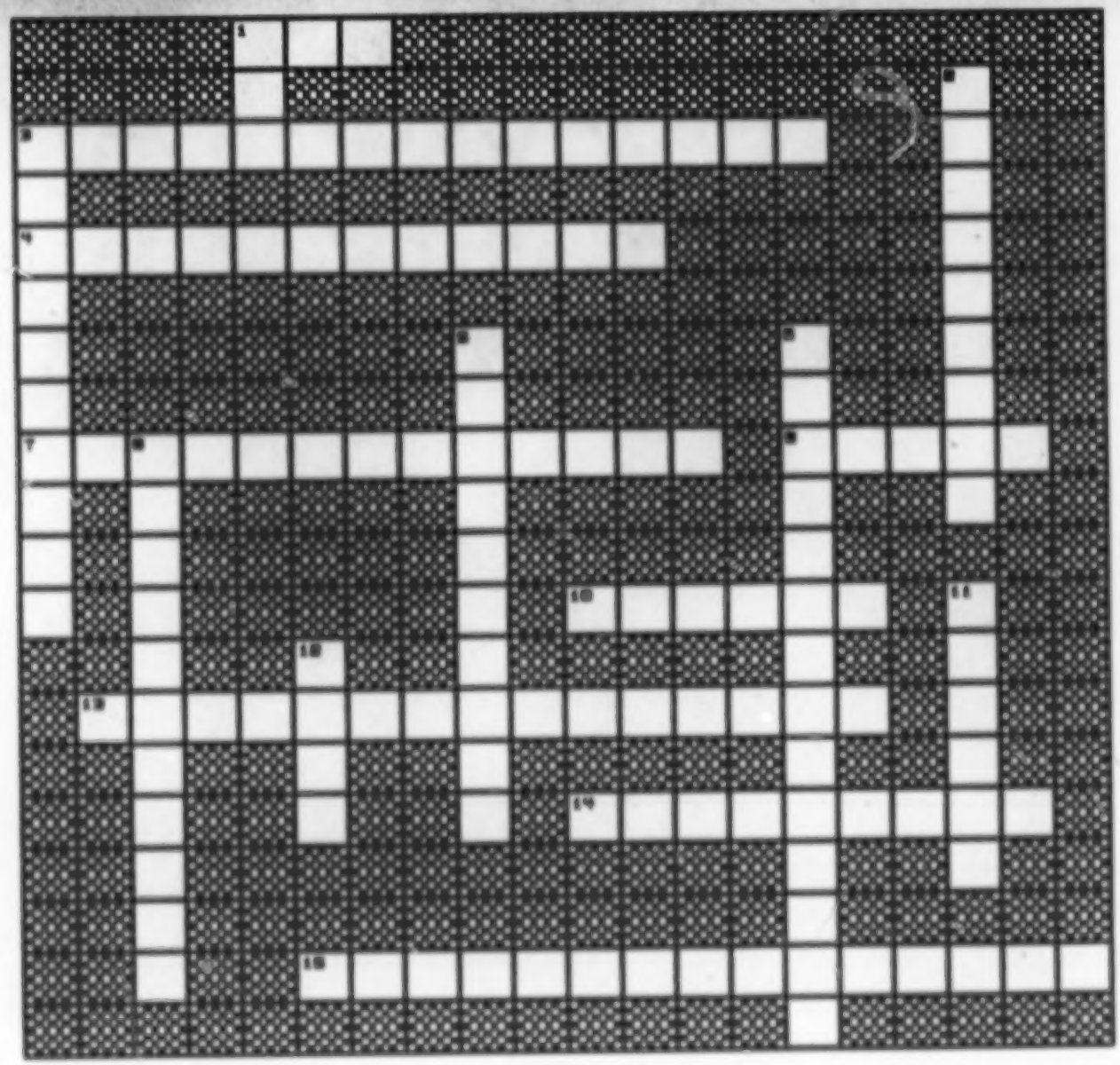


STAR NETWORK



APPENDIX 6

CROSSWORD PUZZLES



ACROSS CLUES

1. A binary digit.
3. A device for sending and receiving data transmissions over telephone without direct connection.
4. The transmission of one character at a time.
7. A modem that is connected directly to the telephone by plugging it into a telephone jack.
9. A device that allows a computer to send & receive data over the telephone network.
10. A holding area within your computer's memory.
13. A standard plug and socket with predefined connections used to transmit serial bits.
14. The transmission of data from files on the personal computer to data bases on the host.
15. WAN

DOWN CLUES

1. Bulletin Board System
2. Any letter, number, punctuation mark, or special symbol transmitted during data communication
3. Information representation by means of continuously varying quantities.
5. The transmission of groups of characters over a communication line without start or stop bits.
6. A communication channel that allows the transmission of data stored in one direction only.
8. A series of computers communicating with one another and without a centralized host computer.
11. Connected to or accessible through a computer system.
12. A measure of the rate at which data is transmitted over a communications link.

WORD LIST: TELECOMMUNICATIONS

ACOUSTICCOUPLER
ANALOGDATA
ASYNCHRONOUS
BAUD
BBS
BIT
BUFFER
CHARACTER
DIRECTCONNECT
MODEM
ONLINE
RINGNETWORK
SERIALINTERFACE
SIMPLEXCHANNEL
SYNCHRONUS
UPLOADING
WIDEAREANETWORK

ANSWERS: TELECOMMUNICATIONS

ACROSS CLUES

4. Refers to transmitting letters and messages via communications channels.
6. dual inline plug
9. A formal set of rules governing the format and relative timing of message exchanges.
10. A communication channel that allows the transmission in one direction at a time.
11. This feature allows a modem to take the telephone off the hook when it rings and communicate.
14. A modem located adjacent to the pc and connected to the computer by a cable.
17. This is the number of bits used to represent each character.
18. Modems that contain a microprocessor which controls many functions.

DOWN CLUES

1. A communication channel that the transmission of data in both directions at the same time.
2. American Standard Code for Information Interchange
3. Local Area Network
5. Bits are transmitted simultaneously.
7. Modem that is installed internally in a personal computer.
8. Receiving a file from another computer and storing the file on disk for later use.
11. Feature that allows the computer to dial telephone numbers.
12. A device that displays data received from a remote computer.
13. The code for each character must be preceded by this.
15. An adaptor or cable used in connecting two computers via their RS-232 ports.
16. A large computer system used by commercial information service providers, school & businesses.

WORD LIST: TELECOMMUNICATIONS 2

ASCIICODE
AUTOANSWER
AUTODIAL
DATABITS
DIP
DOWNLOADING
ELECTRONICMAIL
EXTERNALMODEM
FULLDUPLEX
HALFDUPLEX
INTERNALMODEM
LAN
MAINFRAME
NULLMODEM
PARALLEL
PROTOCOL
SMARTMODEM
STARTBIT
TERMINAL

ANSWERS: TELECOMMUNICATIONS 2

TELECOMMUNICATIONS 2